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1929-1949

With this issue, THE PETROLEUM ENGINEER begins its 21st year of publication. It began as a pioneer venture to fill a void that then existed in petroleum trade journals. That void was a lack of authentic, factual information on improved methods and current practice that could be put to immediate practical use by engineers and operating men in the exploration, drilling, producing, refining, gas processing, and pipe line branches of the industry. To provide this lack was the purpose for which the PE was founded and a definite and consistent editorial plan adopted.

The stature it has attained among the leading oil publications is mute evidence of the wisdom of adopting and adhering to an editorial program designed to foster more efficient field and plant methods and practices. Our editors have the sincere conviction that by keeping readers informed on current operating methods and new and improved equipments and their applications, an essential service is rendered that contributes substantially to progress in the petroleum industry.

Since October, 1929, when the first number of the PE appeared, developments and changes in operating methods and equipment have been many and rapid. In 1929, the engineer and technically trained man were beginning to get a foothold in the operating branches of the industry. As operating methods in petroleum became more involved, the need became more insistent for sound scientific procedure and practice. There was a gradual transformation from what was then largely rule-of-thumb practice to scientific procedure. This transformation is still going on, and at an accelerating pace.

During the last twenty years we have seen the rise of geophysical methods in oil exploration; the deep drilling record increased from 9280 ft in 1929 to 20,521 ft in 1949; the producing well depth increased from 8523 ft in 1929 to 15,866 ft in 1949; the development of catalytic cracking in refining; the rise of cycling plants and manufacture of liquefied gases from condensate fields. These do not begin to highlight the pace of progress during that period.

In recent years, there has been a trend toward specialization among oil industry personnel. To meet this situation and provide its readers a plan whereby they may select the editorial coverage they wish, the PE added three specialized magazines in January of this year. This was done to meet the needs of a rapidly expanding industry and without departing from its consistent editorial purpose, that of catering to the different operating divisions of the oil industry. It is our avowed purpose to continue to be a foremost medium for the timely dissemination of authentic, factual information on current operating procedures and equipment in use in the petroleum industry.

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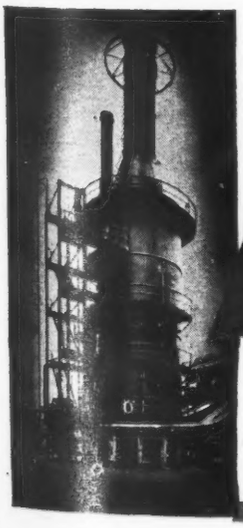

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Scanning WASHINGTON'S OIL HORIZON

By MILBURN PETTY

WASHINGTON—An attempt to link oil proration and prices probably will be made when the special committee, headed by Senator Maybank, South Carolina, resumes its investigation of oil prices this fall.

Maybank's staff is now completing a report on the committee's investigation of gasoline prices, based largely on hearings last June, which were featured by charges that oil prices were being "rigged" by curtailment of production.

Recently, the committee has been pressured by labor groups to investigate "how production is restricted and why supply and demand does not work in the petroleum industry."

So, it is likely that the current investigation of fuel oil prices, ordered by Maybank, will inquire into state proration laws, too.

Imports. The IPAA, working through Senator Thomas, Oklahoma, probably will seek enactment of a special bill to restrict oil imports to not more than 5 per cent of domestic demand. This is a natural consequence of the IPAA's "moral victory" during the Senate's consideration of the trade agreements bill when an oil import quota amendment lost by only one vote.

The next time, however, there will be more opposition to import quotas from independent marketers, particularly those along the East Coast handling fuel oil. Already, they are presenting their views to Congress, contending that imports have been necessary in the past to supplement domestic supplies and may be needed again at a not-too-distant date.

The oil import subcommittee, headed by Congressman Keogh, New York, plans to call in the importing companies, one by one, for cross-examination on their questionnaire returns. Later, the committee will hold further field hearings in the oil country.

Refiners. Chairman Patman of the House Small Business committee has advised the newly-reorganized Gulf Coast Refiners Association that "the situation confronting both independent producers and refiners will be thoroughly explored (by the Keogh oil import subcommittee) and remedial action taken at the earliest possible moment." In a letter to GCRA President Hovey (Danaho), Patman also said, "Your problems, I know, are very serious in the face of increasing imports and falling market prices." (Earlier, Patman had thought the refiner's situation did not come within scope of the import investigation.)

Mexico. President Truman has issued instructions for U. S. Ambassador Thurston at Mexico City to reopen negotiations with the Mexican government regarding a U. S. government loan to finance construction of oil facilities by Petroleos Mexicanos, the government oil company. Earlier, Truman had predicted that the negotiations would be resumed and said he expected that such a loan would be granted. So, it is an odds-on bet that Pemex will get a loan; how much, is the only question.

Tankers. With something like a hundred American-flag commercial tankers laid up, the U. S. Maritime Commission is working on plans for relieving the situation. One suggestion, sent to the White House by the USMC, was that the Navy should lay up the fifty wartime tankers (on loan from the USMC) it is now operating through agents and charter privately-owned vessels. Navy is resisting this proposal.

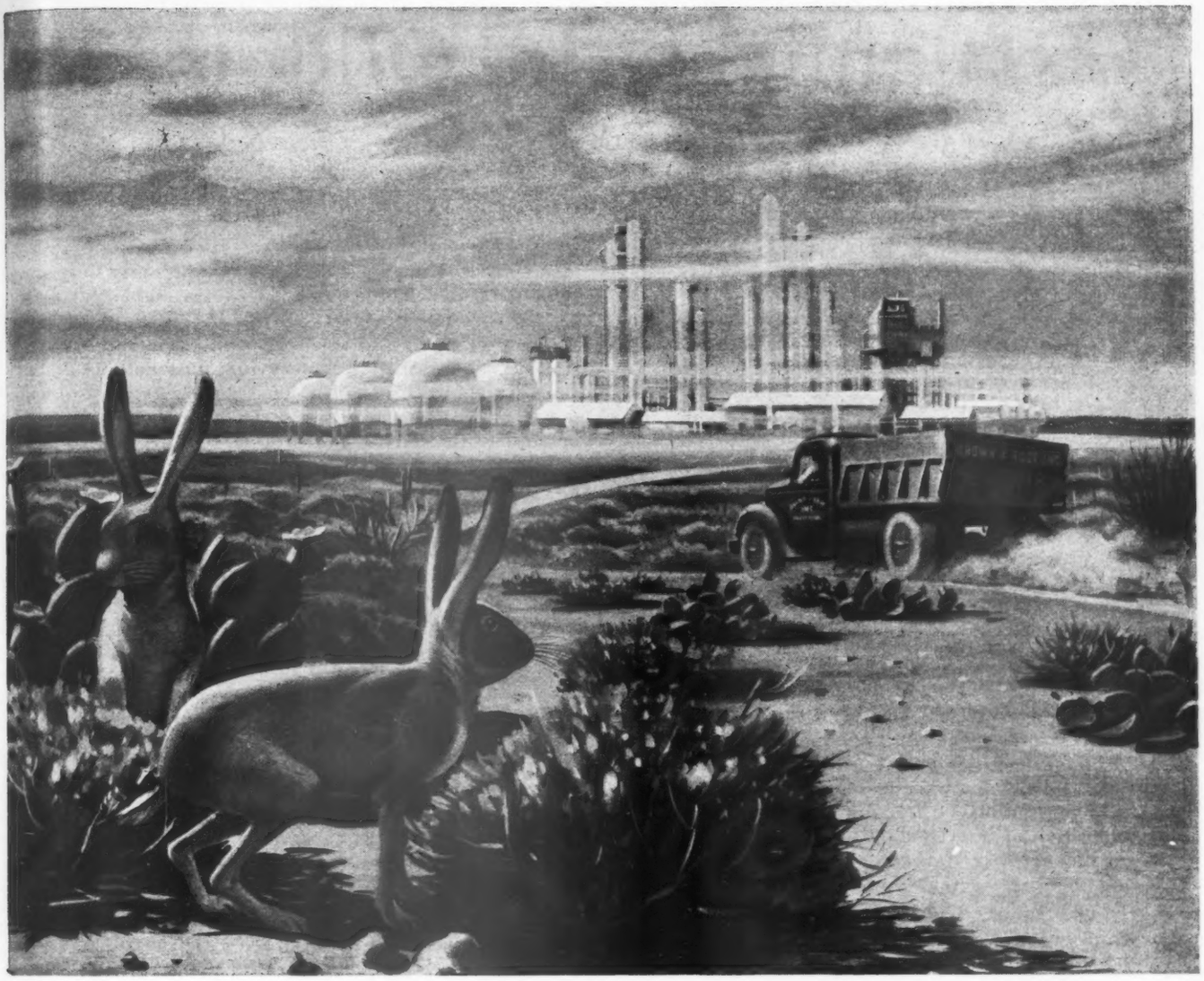
Indeed, Navy has before it several ideas that would provide more business for its tanker fleet. One suggestion is that all the Army's sea-borne oil transportation requirements should be handled by the Navy. Another is that the Navy furnish the transportation when and if the Japanese government starts importing sterling crude for processing at rehabilitated refineries in Japan.

Fuel Oil. Refiners are still debating the suggestion of a fuel oil dealer spokesman that primary suppliers should build enough storage for No. 2 heating oil so that they could be independent of any change in the buying habits of the retail dealers. It is estimated that this would require tankage for about 12,000,000 bbl for the area east of the Rockies, alone. Several major companies are said to be inclined to agree but another contends that adequate storage should be provided at all levels, including the consumers. Concensus is that something must be done to avoid fuel oil backing up at refineries as happened this past summer during the "buyer's strike" that prevailed for several months.

Interior. J. A. Krug's long-expected departure from President Truman's Cabinet now seems near at hand. When and if it occurs, it is virtually certain that Krug's successor as Secretary of the Interior will be Oscar Chapman, now the Undersecretary, who came to Interior with Harold L. Ickes in 1933. Meanwhile, the list of "prospects" for the directorship of the Oil and Gas Division has been just about exhausted with none willing to accept; so the post vacated by Max W. Ball is still unoccupied. Also, it has been recommended to Krug that OGD's functions be transferred to the Bureau of Mines but he has not acted yet on the suggestion.

Oil Leases. Interior Department has promised that the industry will get a chance to voice its views, either at a public hearing or through the National Petroleum Council, before any basic changes in public lands leasing policies—such as those advocated by Assistant Secretary Davidson—are adopted. Davidson has given instructions for the drafting of a new regulation requiring that public lands leases be auctioned to the highest bidder where the land has been "proved up" since the lease application was filed. Also, Davidson has issued orders to hold up any application on acquired lands where a "competitive" interest has been shown; previously, the rule was that the lease went to the first applicant.

API. Changes in the organization and setup of the American Petroleum Institute are now being considered by the directors, with final decision probably to be made at the Chicago meeting in November. After several months of exhaustive study, a committee—headed by L. S. Fish (California Standard)—has submitted a report and recommendations. Among the changes suggested were: (1) Move the API headquarters from New York to Washington; (2) Close the Dallas production division office, move the staff to headquarters; (3) Merge the public relations activities with those of the state petroleum industries committees and (4) Set up two new divisions, one on petroleum industry relations and the other for research and engineering. The API must also find a successor to Wm. R. Boyd, Jr., who insists that he is going to retire this fall—not a year from now, as he had earlier indicated.



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Highlights in Oildom

Devaluation Affects Canadian Oil. The Canadian Minister of Finance, Hon. Douglas Abbott, announced on September 19, devaluation of the Canadian dollar. The exact terms announced are that persons wishing to buy United States dollars will pay $1.10½ and persons wishing to sell will receive $1.10 in Canadian funds for each U. S. dollar. Transactions, as formerly, will be conducted with the Canadian Foreign Exchange Control Board through any of its agents, the chartered banks of Canada. Floyd K. Beach, who wrote "Canada, 1949," Page B7, reported this development.

This devaluation meant a rise in cost of supplies for drilling and producing oil in Canada since most of such items are purchased from U. S. manufacturers. Imports of oil to Canada are likewise affected. While imports to refiners in the prairie provinces have fallen to a minimum, the price structure in the principal Alberta fields is based on the competitive cost of comparable quality of oil delivered at, say, Regina. Following the September 19 devaluation of the Canadian dollar, Imperial Oil Limited announced on September 24 increases in field price of crude oil amounting to 20 cents per barrel for Turner Valley and Redwater and 25 cents for Leduc-Woodbend-Golden Spike.

In the interval between September 19 and 24, the Board of Transport Commissioners of Canada issued a decision on an application made last year by the railways to increase freight rates following a wage increase award. The decision allows an 8 per cent hike in freight rates, applicable 10 days after publication of new tariffs. The hoist in field price of crude oil did not take into account the change in freight rates, and there is a supposition that some adjustment in field prices may follow application of new freight tariffs.

In the meantime, the field price advance was concurrent with a hoist in price of motor gasoline varying from seven-tenths of a cent per (Imperial) gallon at Edmonton to one cent at Calgary and up to 1½ cents at eastern Canadian points. There have been intimations that refiners consider they have been operating on too narrow a margin, and some attempt will be made to correct this.

May Double Tax. Missouri's governor has signed a bill doubling that state's two cent gasoline tax. One of the extra cents goes for low type rural roads. Governor Forrest Smith has issued a statement calling on Missourians to defeat plan to hold up the program by referring it to popular vote in the November, 1950 popular election. He urged citizens to refuse to sign referendum petitions.

Opponents of the tax increase have announced they will start circulating referendum petitions soon. They state their campaign to get 55,000 signatures and put the referendum proposal on the ballot is all ready to go.

Free Enterprise a Must, Hallanan Says. "The survival and prosperity of the independent oil operator is indissolubly bound up with the survival and prosperity of the American people," Walter S. Hallanan, Chairman of the National Petroleum Council, declared at the 20th anniversary of the Independent Petroleum Association of America. He told the group meeting in Fort Worth, Texas that there was room for both the major integrated companies and the independent operators, but a proper proportion must be maintained between the two. He stated that the oil industry had met every demand during its 90-year life, and will move forward to meet the new and greater responsibilities of tomorrow, provided it is permitted to work in a political climate that permits freedom of action.

Hopes for Oil in Arizona. Despite the fact that Arizona is the only Southwest state that has never produced a barrel of oil, O. C. Williams, land and water commissioner for that state, still hopes for an oil strike. He gains support from geologists who point out that although no oil has ever been found, Arizona has geologic structures similar to its oil-producing neighbors.

ECA Aids Refining Expansion. Installations of three French and two British oil refineries will be expanded under industrial recovery projects approved by the Economic Co-operation Administration. Over-all cost of the projects is estimated at $150,465,000. ECA will cover $21,420,500 of the total.

The three French refineries to be expanded are: The Berre refinery, Compagnie de Raffinage Shell; Notre Dame de Gravenchon refinery, Socony-Vacuum Francaise (SVF), an affiliate of Socony Vacuum; and the Port Jerome refinery of the Standard Francaise des Petroles, an affiliate of Standard of New Jersey. The English refineries are: The Shell Haven refinery, Shell Refining and Marketing Company, Ltd., and the Llandarey refinery of the National Oil Refineries, Ltd., a subsidiary of Anglo-Iranian.

Oil Editors Awarded. Several oil house organs received awards recently at the meeting of the Society of Associated Editors in Kansas City, Missouri. *The Connecting Rod*, edited by Cleve Bullette of Stanolind Pipe Line Company of Tulsa, Oklahoma received the Clement E. Trout annual award for the best article or editorial, and a general improvements award.

The Link, publication of the Carter Oil Company, edited by H. J. Van Dyke, Tulsa, and the *Sun Ray News*, Luther Williams and J. E. Brown, editors, received awards for excellence in their classifications, and *The Link* was given an additional award for improvement. *The Natural Gasser*, publication of Warren Petroleum Corporation, Tulsa, edited by R. C. Pattison, and *Philnews*, publication of Phillips Petroleum, Bartlesville, C. E. Cummings, editor, received an award of merit in its classification.

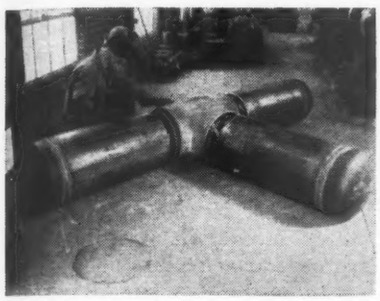
Automobiles Defeating Own Purpose. The automobile may be defeating its own purpose, due to rising operating costs and growing congestion, Alexander Fraser, president of Shell Union Oil Corporation, stated in a speech before the National Petroleum Association.

The outstanding advantage of the automobile over other forms of transportation, he declared, is the freedom of movement it provides for the individual. This freedom of movement is being lost in traffic jams caused by inadequate streets and highways and lack of parking facilities. Fraser called upon the oil men to support officials in strict enforcement of traffic laws, to support behind-the-wheel instruction for all high school students, and to support long-range highway planning.

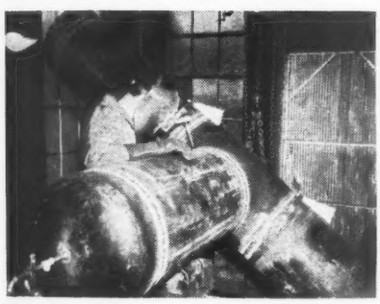
Holman Speaks on Foreign Oil. Eugene Holman, Standard Oil, New Jersey, stated before the joint economic committee, that before Standard and its affiliate, Anglo-American Oil Company, started $150,000,000 refinery expansion at Fawley, England, a commitment was obtained from the present British government that the oil industry in the United Kingdom would not be nationalized and that a certain amount of the refinery's earnings could be converted.

TUBE-TURN

WELDING FITTINGS AND FLANGES



18-inch standard weight Tube-Turn welding tee and pipe laid out preparatory to assembly for hydrostatic pressure test.



Welder completing last bead in assembly. Fitting and pipe now form homogeneous, leakproof unit.

Assembly is hung in pit, massively lined with concrete. During test top grating is closed and held down by a barricade of sandbags.

Final result after hydrostatic pressure test. The straight pipe burst first, and the tee is undamaged.

Strength through Design in Tube-Turn welding fittings

The pipe burst first!

Take an 18-inch standard weight welding tee. Take three corresponding lengths of pipe. Weld tee and pipe together. Cap the ends. Lower the assembly into a pit. Then apply hydrostatic pressure—much more than the assembly is supposed to take!

Something has to give! According to the accepted beliefs it should be the tee. But not in the case of the test pictured here. The Tube-Turn "barrel-shaped" tee was used—and the pipe burst, well before the tee was affected! Throughout numerous tests, this new type of tee has withstood at least 25 per cent more pressure than required by the formula given in ASA B16.9.

The superior strength of the tee was achieved without running up extra weight and cost, by carefully planned improvements in shape (based on the sphere, nature's strongest form for internal pressure), and by a carefully engineered distribution of metal.

Tube-Turn "barrel-shaped" welding tee

This is a typical example of *strength through design* in Tube-Turn welding fittings, and another good reason why leading piping engineers specify Tube-Turn equipped, welded piping.

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National Petroleum Situation

Sharp Demand Gain. Demand for all oils in August increased about 166,000 bbl daily over July. Preliminary estimates indicate August demand was 5,904,000 bbl daily, against 5,738,000 bbl in July. Demand exceeded supply by about 173,000 bbl daily, which resulted in a net draft on stocks of all oils of 5,378,000 bbl. Stocks of all oils on August 31 were reduced to 629,460,000 bbl, representing 106 days supply, against 111 days supply on July 31. Revised data for July indicated a net draft on stocks of 373,000 bbl, instead of an increase, as previously reported. Bureau report for July had not been received before press time.

Fuel Oils Moving. The long awaited turn in fuel oil buying began during August and was given further impetus in the first half of September. Realization of dealers and consumers of the need for restocking against next winter's requirements brought a resumption of buying in August and accelerated movements in September. August demand was about 1,880,000 bbl daily, which was roughly 50,000 bbl greater than in July. Announcements of price increases in heating oils, kerosine and heavy fuels during September were followed by much heavier shipments from principal refining centers. Stocks of fuel oil on August 31 amounted to 75 days supply, against 66 days last year. Indications point to heavy stock withdrawals in October and November and the likelihood that current stocks are far from being excessive.

More Crude Needed. With the immediate outlook for a decidedly heavy demand for fuel oils, particularly in the face of another coal strike, there is a strong sentiment for materially increased crude oil production. Refining operations are due to be stepped up sharply at an early date and higher crude output appears decidedly necessary. The increase in Texas October allowable of 140,000 bbl daily is disappointing to many oil operators. National crude demand in August exceeded supply, including imports by 233,000 bbl daily. Deficit is expected to be greater in both September and October.

Wildcat Drilling Brisk. Continuation of strong crude markets this year has favored active exploration for new fields on a wide front. Operations this year are 12 per cent above last year, with gain in discoveries of 14 per cent. Development drilling is only 4 per cent above last year, while service wells are 41 per cent below last year.

Comparative Statistics, August, 1949

*All figures are computed on a Bureau of Mines' Basis**

	August 1949Ⓟ	July 1949Ⓟ	August 1948	This Year to date	Last Year to date	Per cent change
Total supply, all oils	177,656	177,511	200,523	1,469,630	1,545,118	— 5
Daily average	5,731	5,726	6,468	6,048	6,332	
Total demand,‡ all oils	183,034	177,884	185,588	1,450,913	1,493,324	— 3
Daily average	5,904	5,738	5,987	5,971	6,120	
Change in stocks	—5,378	—373	+14,935	+18,717	+51,794	
Crude supply*	159,460	158,900	183,769	1,323,826	1,409,716	— 6
Daily average	5,137	5,125	5,928	5,448	5,777	
Crude demand‡	166,470	165,581	182,770	1,320,453	1,408,416	— 7
Daily average	5,370	5,341	5,896	5,434	5,772	
Crude stocks	264,800	268,000	231,954	264,800	231,954	+14
Days supply	49	50	39	49	39	
Natural gasoline production	12,435	12,468	12,129	99,485	94,823	+ 5
Daily average	401	402	391	409	390	
Motor fuel production	82,400	82,500	80,711	634,763	606,197	+ 5
Daily average	2,660	2,661	2,604	2,612	2,484	
Gasoline yield percent	45.0	45.7	41.0	43.8	39.9	+ 3.9
Motor fuel demand‡	86,190	86,949	83,702	630,963	600,181	+ 5
Daily average	2,780	2,804	2,700	2,600	2,460	
Motor fuel stocks	104,860	110,650	95,445	104,860	95,445	+11
Days supply	37	39	34	37	34	
Fuel oil production	57,570	58,640	70,873	487,767	565,575	—12
Daily average	1,857	1,891	2,286	2,048	2,318	
Fuel oil demand‡	58,205	56,823	62,236	537,761	587,076	— 9
Daily average	1,880	1,833	2,008	2,213	2,406	
Fuel oil stocks	143,215	137,400	132,914	143,215	132,914	+ 7
Days supply	75	77	66	75	66	
Refinery still runs	161,910	160,358	174,272	1,287,059	1,348,460	— 5
Daily average	5,223	5,173	5,621	5,296	5,526	
Stocks, all oils	629,460	634,838	552,594	629,460	552,594	+14
Days supply	106	111	92	106	92	

Current Crude Oil Prices

U. S. Average	$2.55	Louisiana	$2.62
Texas	2.61	Arkansas	2.43
California	2.42	New Mexico	2.40
Oklahoma	2.63	Mississippi	2.26
Kansas	2.62	Illinois	2.76
		Other states	2.60

Basic crude prices:

Oklahoma-Kansas (36 gr.)	$2.57
Texas Gulf Coast (36 gr.)	2.80
East Texas	2.65
West Texas (36 gr.)	2.44
California Signal Hill (26 gr.)	2.31
Pennsylvania, Bradford	3.40

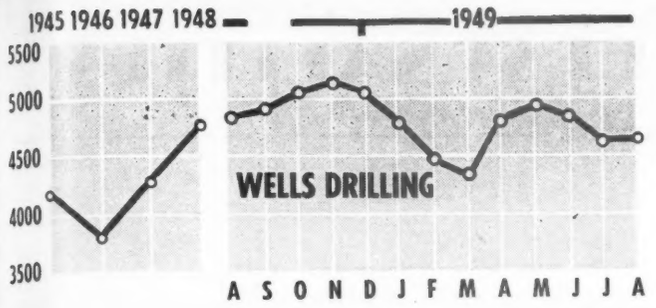
Drilling and Production Statistics

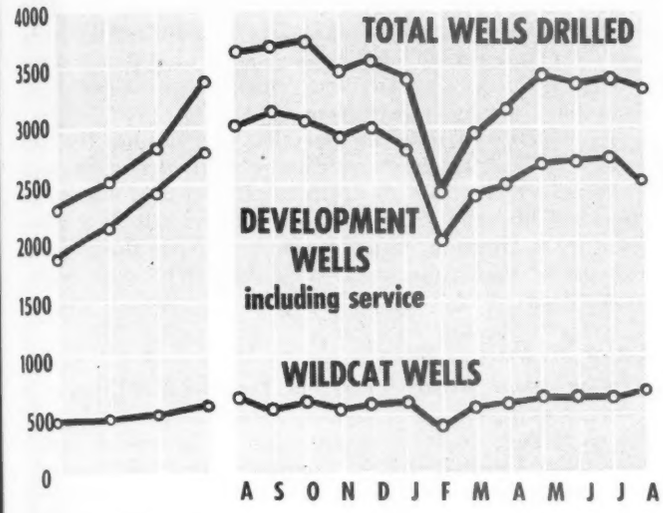
	August 1949Ⓟ	July 1949Ⓟ	August 1948	This Year to date	Last Year to date	Percent change
Wells drilling	4,640	4,600	4,790	4,640	4,790	— 3
Total wells drilled	3,247	3,371	3,546	25,404	24,670	+ 3
Development wells	2,532	2,686	2,781	20,121	19,299	+ 4
Oil	1,655	1,738	1,871	13,588	13,409	+ 1
Gas	243	239	258	1,783	1,618	+10
Dry	634	709	652	4,750	4,272	+11
Per cent dry	25.0	26.3	23.4	23.6	22.1	+ 1.5
Service wells	88	76	155	807	1,362	—41
Wildcat wells	627	609	628	4,476	4,009	+12
Oil	105	95	106	708	631	+14
Gas	16	23	26	120	173	—31
Dry	506	491	496	3,648	3,205	+14
Per cent dry	80.7	80.9	79.0	81.6	79.9	+ 1.7

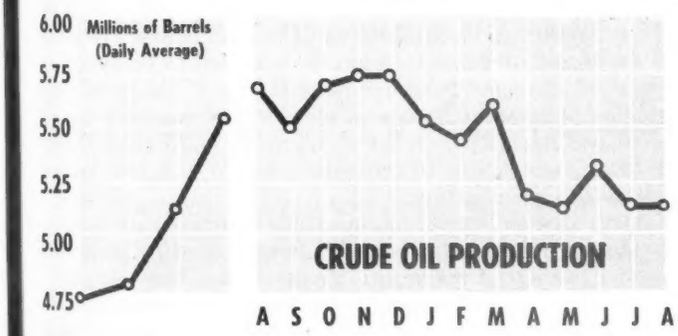
By State

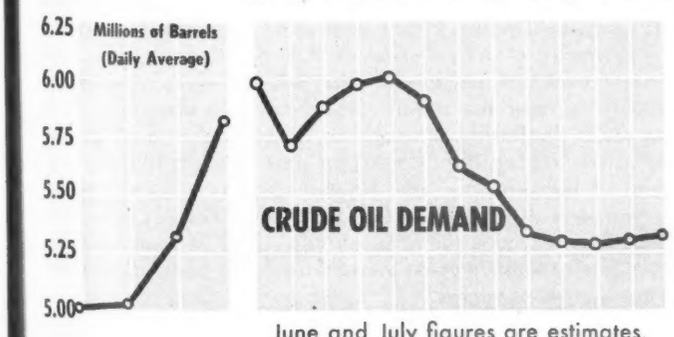
Wells drilled (excl. service)	3,159	3,295	3,409	24,597	23,308	+ 6
Arkansas	29	35	31	215	196	+ 5
California	182	214	264	1,699	1,909	—12
Illinois	261	271	225	1,645	1,504	+ 9
Kansas	300	323	262	2,122	1,981	+ 7
Louisiana	231	240	213	1,503	1,472	+ 2
Mississippi	29	26	44	232	268	—13
New Mexico	35	35	47	324	401	—19
Oklahoma	397	375	392	2,783	2,676	+ 4
Texas	1,084	1,132	1,077	9,247	7,641	+21
Other states	611	644	854	4,827	5,260	— 8
Wildcats drilled	627	609	628	4,476	4,009	+12
Arkansas	9	8	16	43	68	—37
California	44	40	55	339	292	+16
Illinois	58	58	55	306	270	+13
Kansas	52	41	53	335	330	+ 1
Louisiana	24	32	34	214	197	+ 9
Mississippi	11	7	16	72	65	+11
New Mexico	5	7	5	53	40	+32
Oklahoma	91	83	72	540	543	— 1
Texas	241	238	236	1,958	1,650	+19
Other states	92	95	86	616	554	+12
Daily crude production	4,786	4,720	5,577	5,040	5,460	— 8
Arkansas	80	74	87	83	89	— 7
California	901	907	950	926	942	— 1
Illinois	162	160	181	171	176	— 2
Kansas	247	241	310	280	300	— 7
Louisiana	490	490	504	511	480	+ 6
Mississippi	97	97	130	105	123	—15
New Mexico	123	132	132	131	129	+ 2
Oklahoma	375	376	424	408	413	— 1
Texas	1,854	1,808	2,476	2,038	2,436	—17
Wyoming	137	130	154	129	146	—12
Other states	320	305	229	258	226	+14

*Unless otherwise stated all figures represent thousands of barrels. Ⓟ—Preliminary. *Includes domestic production and imports.
‡Total demand, including exports. Note—May and cumulative data revised to reflect changes in reporting by U. S. Bureau of Mines.
Preliminary estimates based upon data supplied by American Petroleum Institute, U. S. Bureau of Mines, State Agencies, and other official sources.

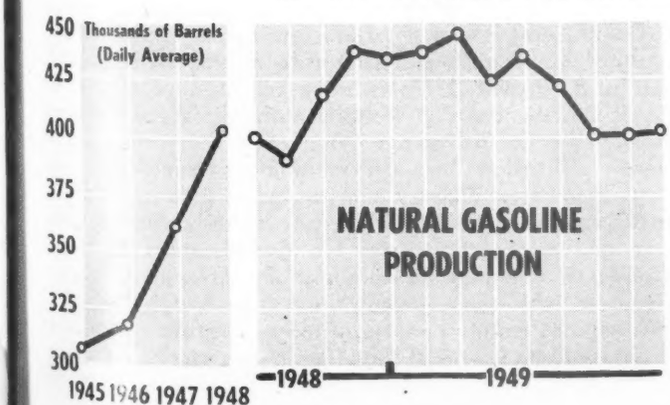


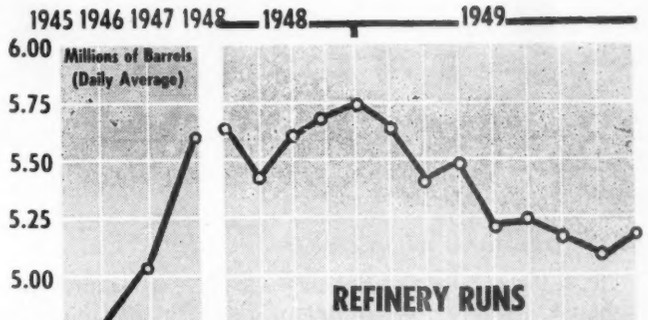


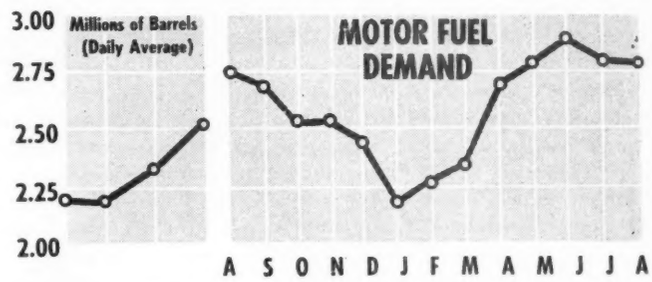


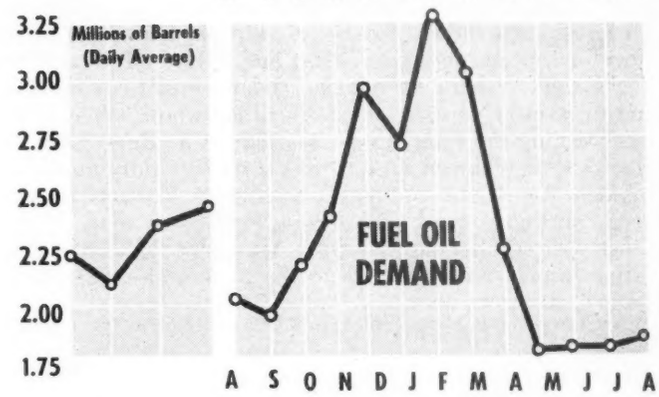


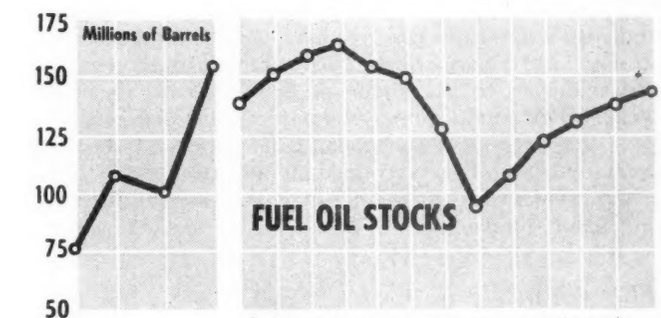
June and July figures are estimates.



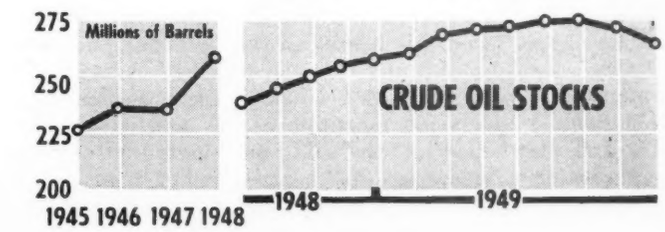








Years 1945-48 are year end stocks



PETROLIC PERSONALITIES

DICK SNEDDON

O'er the Dark Blue Deep

In all the great chronicles of piscatorial adventure, there is none to compare with the harrowing experience that befell a quintet of oil men in South Texas a short time ago. Led by Bill Taylor, vice president of Johnston Well Testing Company at Houston, this brave little band started from Jonesville in a trim motor craft, the *S. S. Dry Hole*, and wiggled its perilous way for four hours and twenty miles up a tortuous creek, in search of crab louie, shad roe, broiled trout filets, and other succulent denizens of the cool, dark waters. The tillermen on this daring sashay were Joe McGhee, the drilling biggie, and Lee Moore of the trucking firm by the same name, as fine a pair of river pilots as ever ran into a rock. The balance of the crew consisted of able seamen, Bill Quigle, general superintendent of the Union Producing Company, Shreveport, Louisiana, and Joe Smith, North Louisiana manager for the Johnston interests.

By skillful manipulation of the mains'l, the tops'l, the bottoms'l, and the rudder, the co-skippers had managed to negotiate rapids and whirlpools; had missed all protruding rocks and overhanging boughs, and were just congratulating themselves on their navigational knowhow, when, without warning the little vessel capsized. In no time at all the waters were whipped into a stiff cream by wildly threshing oil men. A miscellany of logged mattresses, blankets, canned food, uncanned food, and fishing equipment made swimming difficult, but the powerful strokes of the determined sailors finally brought them to the bank and safety—temporary safety, at least.

Pirates!

They salvaged as much of their soggy kit as they could recover, and were fortunate—they thought—to find an abandoned house near by. In this they planned to bed down for the night. But a nest of wasps had other plans. The dastardly insects waited quietly around until Bill Quigle had taken his pants off, then, with lowered heads and pointed lances, they came at him in full formation. His screams were distinctly heard in Houston.

Meantime, Bill Taylor, safely ensconced in a sleeping bag, and with a mosquito net over his head, directed the defense strategy, but it was a tough battle and before the voyageurs had managed to get under protective cover, the yellowjackets had administered a series of sub-cutaneous injections that caused no end of later discomfort. At last, however, soporific fatigue shrouded all pain, and one by one the adventurers soaked their pillows as they sobbed themselves into fitful slumber.

The Calm

But the end was not yet! The party still had to get back to Jonesville—and with a boatload of wet motors, too. The twin skippers faced this herculean task with fortitude and a great wrinkling of brows. They distributed their cargo—human and otherwise—with a delicate hand, to be dead sure that there would be no repetition of the dousing episode. Then off they sailed into the wild blue, singing an old seasick chantey, "Heave ho, my hearties!" For a brief few minutes all went well, then with a series of deep-seated bronchial coughs three of the motors expired, and the remaining one sputtered feebly. This latter continued to operate spasmodically, however, for approximately six hours, and at last the *S. S. Dry Hole* hove hesitatingly into Jonesville, where her crew and passengers, looking somewhat bewhiskered and bedraggled, were given a tremendous ovation by two small boys and an elderly lady.

It is worthy of note, incidentally, that despite the near tragedy with which this expedition was threatened, the principals returned with a generous creelful of fish, which they dispensed liberally to a small army of friends at a subsequent fry in Houston. And our reporter, Floyd Morgan, who was one of that army, states that the catch made mighty good eating.

Take a Bow

Comes word at this point that Tommy Ward, prexy of Oilfield Equipment Company, has a son, Thomas E., Jr., who is back at Yale for his final year, after an interesting experience with Mene Grande Oil Company down in Venezuela. If Ward Minor inherits the attributes and qualifications of his justly famed pater, Yale is going to be all puffed up about another of its grads one of these fine days. The head of the House of Ward is generally conceded to be the originator of the petroleum equipment export business, and whether or no, there is no question that he numbers among his acquaintances the cream of American and British manufacturers, and is one of the most traveled and best known men in the oil industry.

According to legend, he began his business career as an accountant, and his facility with figures is still a matter of wonder to most of his immediate associates. However, he is too much of an extrovert to spend his life putting decimals in their places, and he has a conversational ease and general savoir faire that mark him at once as big time. He also has the typically smooth diction of the educated Anglican, and we are told that he does a neat job of balancing a cup of freshly infused tea on his lap come late afternoon. It is popularly believed, although he doesn't talk about it himself, that he played an important part in the initial development of Bahrein, and that he still garners a royalty shekel or two as a result. Be all that as it may, Tommy Ward has definitely carved a niche in oildom's hall of fame, and has managed to make a great many friends for his company and himself in the process.

Big Webb DeMille

Dallas Nomads were entertained in a pretty generous way recently by that prince of after-dinner speakers, Big Webb, and for the benefit of those who haven't been introduced, we might explain that Big Webb is a colloquialism, meaning Samuel Warren Webster, a Continental Emsco chappie of fairish dimensions and considerable consequence. It appears that Large Webster had just returned from an interesting visit to Argentina, where he was responsible for setting up sundry drilling rigs for Yacimientos Petroliferos Fiscales. It was quite an occasion, of course, and Webster, the Great, who leans—heavily—toward color photography, took copious motion pictures of motion picture cameramen taking motion pictures of spudding in operations, with many Argentinian dignitaries in attendance, and all the glamor

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and excitement that such an event in such a country entails. These he displayed with an accompaniment of highly humorous comment for the Dallasian Nomads, and they liked it so much they are still talking about it. Big Webb, be it known, has an admirable tendency to burst into song in a decidedly enjoyable manner when he is suitably excited, but he was kept so fully occupied on this occasion reciting his colorful adventures that nobody noticed that he hadn't sung. He has a casual, off-the-cuff platform style and a nice sense of humor that together make an hour rush by in about forty minutes, and the Nomads are urging him to take another foreign jaunt soon so that they can have further samples of his easy oratory.

Take Bait, Schanaud

It was our pleasure a short time ago to meet that famous Oklahoman, Cliff Wright, now officiating as superintendent of operations for Arabian-American at Dhahran. Cliff, at the moment of our meeting was under escort by his former associate in the British-American Oil Producing Company, O. I. "Tork" Torkelsen, a lad who rates so high in western cribbage circles that he is popularly referred to as "His Nobs." Returning to the subject of the narrative, however, Cliff was born in the thriving village of Coweta, Oklahoma, some years ago, eventually graduated in petroleum engineering from Oklahoma U, and soon thereafter was functioning as chief petroleum engineer for Indian Territory Illuminating Oil Company, now better known as Cities Service. After that he changed over to British-American and for that organization served as manager of production in the Mid-Continent division. It was at this time that the Wright-Torkelsen acquaintanceship began.

Before this appears in print, Cliff will probably be on his way to Europe with his wife and daughter, and thence will return to Dhahran. He has a son attending Menlo Park Junior College in California. His greatest joy, we understand, that is apart from his family and his work, is fishing in the Persian Gulf for *schanaud* and *hamour*. Personally, we are of the opinion that fish with such difficult names should be dragged out of the water immediately and taught the virtue of simplicity. It could be that Cliff manufactured these two specimens just to make this reporter look naive. Oh well, a smelt or a *schanaud*, what's the difference?

Tally Ho for the Hook Shot

Out to the Flintridge Riding Club last week where Earle Jorgensen, the steel chap, hosted an unforgettable party for that distinguished group of turf swatters—the Nineteeners. The place was none too easy to find, but we made it after doing several unnecessary miles and a lot of asking.

It is reported that George Zero Suman, the Sultan of the San Joaquin, started from Bakersfield in the early morning of the appointed day, reached the general vicinity of the Club in good time, but never did find the entrance. Hourly bulletins arriving today indicate that he is still circling around the Club grounds, whooping like a Cherokee, and is definitely closing in on the joint.

During the evening the Jorgensen guests were well entertained with impromptu songs and banjo selections from Jack Watson, a right able performer. Jack seems to know the words and tunes of every ditty that was ever written and has composed quite a few himself. From dark to dawn he goes on and on and never repeats. He even cooperated with such musical individualists as Hugh Glen, the hill billy guitarist, and Sacha Tuttle, the violin virtuoso, in a fugue or two, and it sounded just as well as if they were in tune.

We hesitate to say so but the real pleasure of the evening was marred by an exhibition of atrocious election etiquette. However, as nearly as we could figure it out, Charlie Perkins, the West's leading exponent of gin rummy, was unanimously acclaimed Big Shot, to replace Paul Huggins for next year. Paul is now at Harvard Business College, enlisted in the Advanced Management course, and doesn't expect to return to California until about the middle of December. Bill Farrar succeeded Charlie Perkins as Little Shot, and they didn't even bother to elect a Hook Shot—Lev Sacre has been it since shortly after the world began. Anyway, apart from all these machinations, the Jorgensen party was a huge success—the highlight of the affair was a barbecued steak dinner that was tops. After that was over, the guests sang to the accompaniment of the aforesaid trio, or amused themselves by passing out little cards and exchanging bright colored disks until the night was far sped.

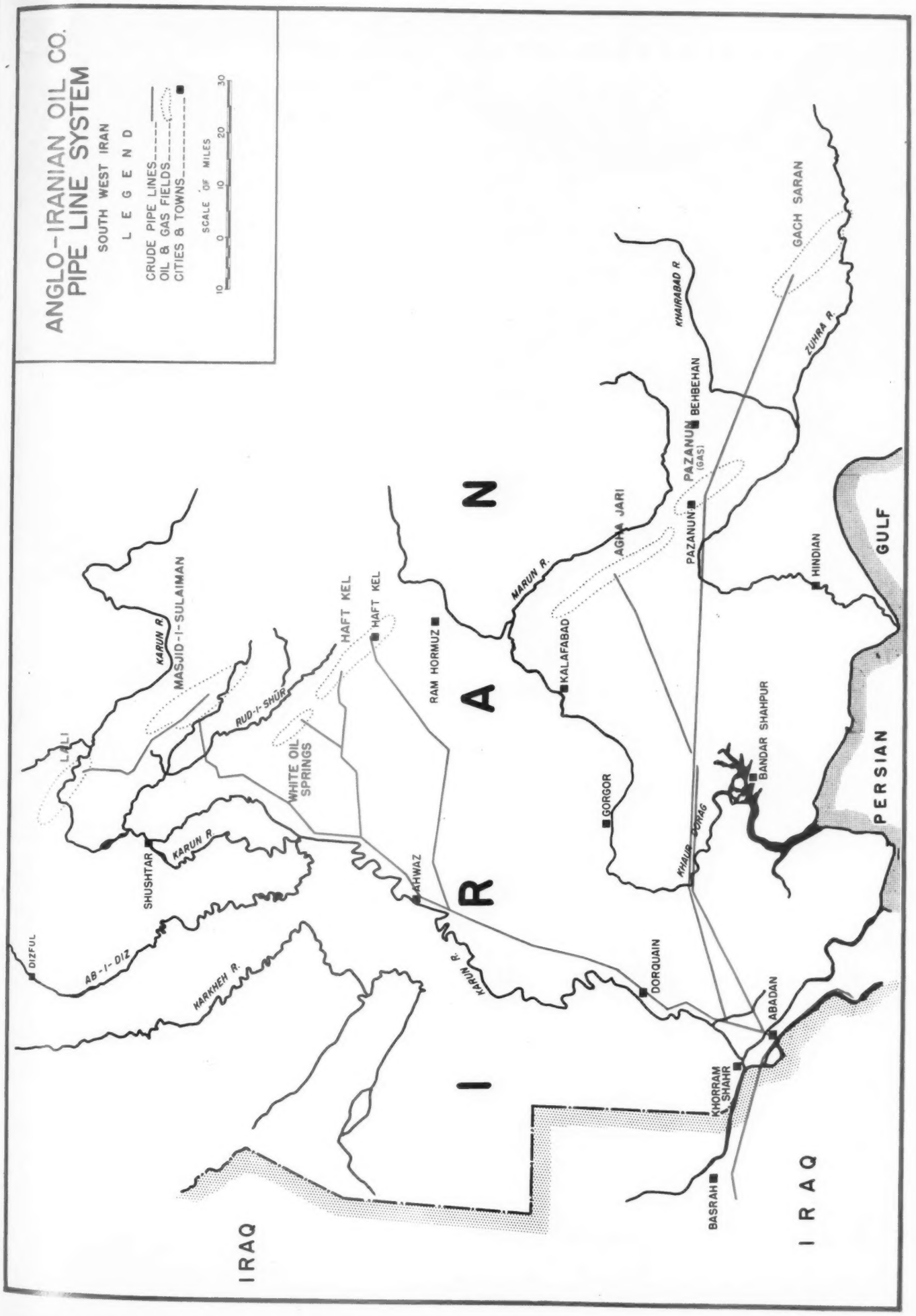
Preparation for Trumpeting

Imagine our surprise three weeks ago to bump into the well known Soconian, Ed Oswald, at the Los Angeles Petroleum Club. Ed was born in New York state, graduated from Lehigh with the class of '27, and had quite a tempestuous athletic career at college. He played lacrosse, and if you don't know what that is, listen to an old Canadian: It is a game in which 15 people lambaste 15 other people with loosely strung, elongated tennis rackets, and at the end of a full 60 minutes of mayhem, a doctor is called in to say who has won. Some authorities claim the Indians invented lacrosse as a preparation for war. Others say, "Preparation heck—it is war!" Anyway, Ed also made the Lehigh football squad but he finds that very difficult to remember after lacrosse.

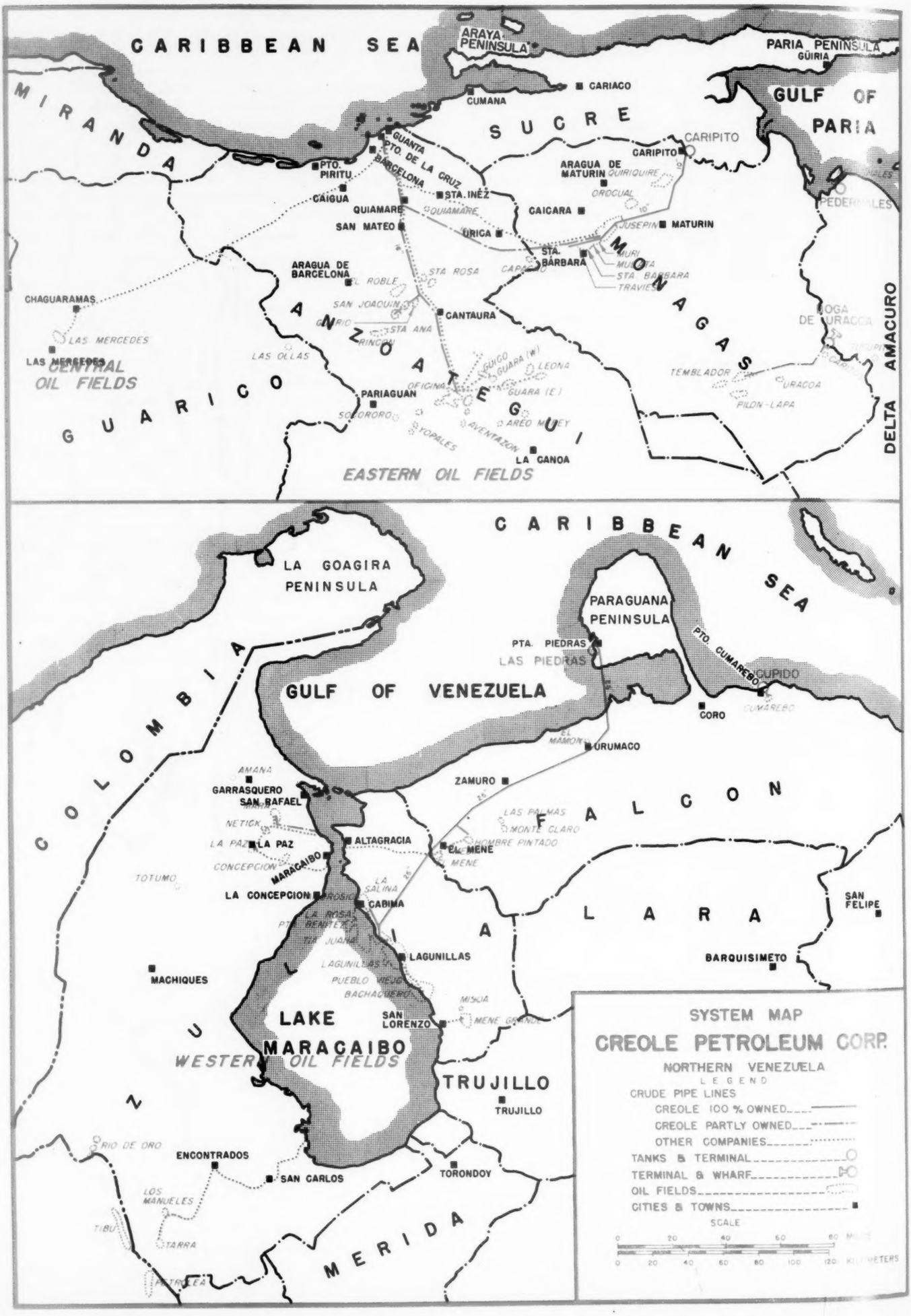
We should have mentioned, in case anyone doesn't know that he is general sales manager and director of Socony Paint Products Company, and is also a maestro of Berniesque stature. As a matter of fact, when we first spotted him on the Angelenic horizon, we immediately jumped to the conclusion that he was probably out here to organize a band. He can coax a mighty sweet note out of a battered trumpet, and he is popularly known on Fifth Avenue as the oil men's Louis Armstrong. Ed traveled all over England during the war training servicemen's bands, tootling his own trumpet, and in general trying to drive away the nostalgia of foreign service by giving the boys an occasional blast of the old home music.

Deer and Fish

We learn just as we go to press that Clyde O. Badgley, for 20 years with Hamer Oil Tool Company in various responsible positions, and one of its most valued employees, has purchased a half interest in Fire Mountain Lodge at Mill Creek, California, and will hereafter devote himself to the operation of the property and its facilities. The Badgley lodge is in the very heart of the finest deer hunting territory in the Pacific southwest, and arrangements are now being made to build a small dam that will create an adjacent four acre trout lake. Indeed, the whole project is being expanded and enhanced, so that several hundred people may be fed at one sitting and may coincidentally enjoy the sport that the resort has to offer. Clyde Badgley has hunted in the region every deer season for the past 15 years, and has long planned to live in it when the occasion was ripe. The occasion appears to have ripened and with his wife and two daughters he is now going to convert his avocation to a vocation. With him in the venture is Al Hilton, a man of many trades, and well experienced in the types of occupation that fit him best for such an enterprise. The oil men, to whom Clyde Badgley especially is well known will wish the pair the most of the best as they launch their new business.



From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.



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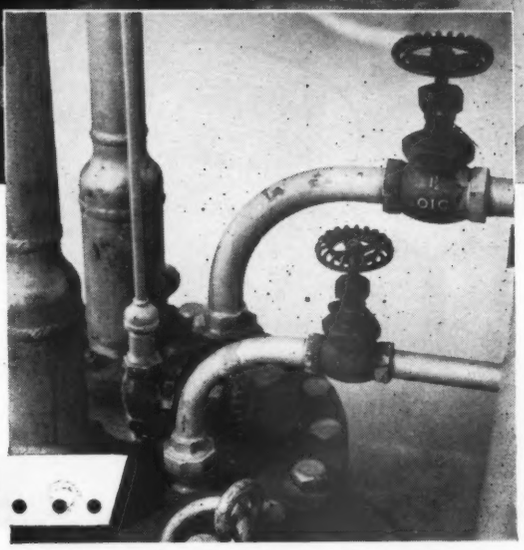

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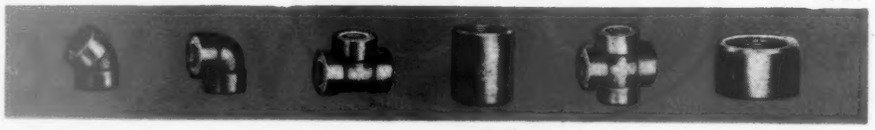

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MEETINGS

Oct. 13-14—Texas Mid-Continent Oil and Gas Association, Annual Meeting, Rice Hotel, Houston, Texas.

Oct. 13-14—Indiana Independent Petroleum Assn., Hotel Severin, Indianapolis, Ind.

Oct. 14—NGAA, Southern Regional Meeting, Blackstone Hotel, Tyler, Texas.

Oct. 16-22—Oil Progress Week.

Oct. 17-20—American Gas Association, Annual Convention, Chicago, Ill.

Oct. 17-21—National Metal Congress, National Metal Exposition, Annual Meeting, Public Auditorium, Cleveland, Ohio.

Oct. 20-21—American Institute of Mining and Metallurgical Engineers, Fall Meeting, Petroleum Branch, Elk's Club, Los Angeles, Calif.

Oct. 21—Western Petroleum Refiners Assn., Regional Technical Meeting, Palmer House, Chicago, Ill.

Oct. 26-27—National Conference on Industrial Hydraulics, Annual Meeting, Sheraton Hotel, Chicago, Ill.

Oct. 31—Independent Natural Gas Association of America, Annual Meeting, Baker Hotel, Dallas, Texas.

Nov. 1-2—Society of Automotive Engineers, St. Louis, Mo.

Nov. 1-5—American Chemical Society, Pacific Industrial Conference and Chemical Exposition, San Francisco Civic Auditorium, San Francisco, Calif.

Nov. 7-10—API, Annual Meeting, Stevens Hotel, Chicago, Ill.

Nov. 17-18—Dallas Geophysical Society and Fort Worth Geophysical Society, Regional Exp. Meeting, Adolphus Hotel, Dallas, Texas.

Nov. 17-18—American Assn. of Petroleum Geologists, Pacific Section, Los Angeles, Calif.

Dec. 4-7—American Institute of Chemical Engineers, Annual Meeting, William Penn Hotel, Pittsburgh, Pa.

1950

Mar. 23-24—New England Gas Association, Hotel Statler, Boston, Mass.

Mar. 27-29—Western Petroleum Refiners Assn., Annual Meeting, Plaza Hotel, San Antonio, Texas.

April 3-6—National Association of Corrosion Engineers, Jefferson Hotel, St. Louis, Mo.

April 12-14—National Petroleum Association, Hotel Cleveland, Cleveland, Ohio.

April 23—Society of Exploration Geophysicists and Society of Economic Paleontologists and Mineralogists, Annual Meeting, Chicago, Ill.

April 23—American Association of Petroleum Geologists, Chicago, Ill.

June 19-24—Canadian Gas Association, Annual Meeting, Manoir Richelieu, Murray Bay, Quebec, Canada.

Sept. 13-15—National Petroleum Association, Hotel Traymore, Atlantic City, N. J.

Nov. 13-16—API, Annual Meeting, Los Angeles, Calif.

NOMADS MEET

New York Chapter, First Monday of the Month, Louis Sherry's, New York, N. Y.

Houston Chapter, Second Monday of the Month, Ye Ole College Inn, Houston, Texas.

Los Angeles Chapter, Second Wednesday of the Month, Jonathan Club, Los Angeles, Calif.

Tulsa Chapter, Third Wednesday of the Month, Hotel Tulsa, Tulsa, Okla.

Dallas Chapter, Texas Room, Baker Hotel, Dallas, Texas, October 31.

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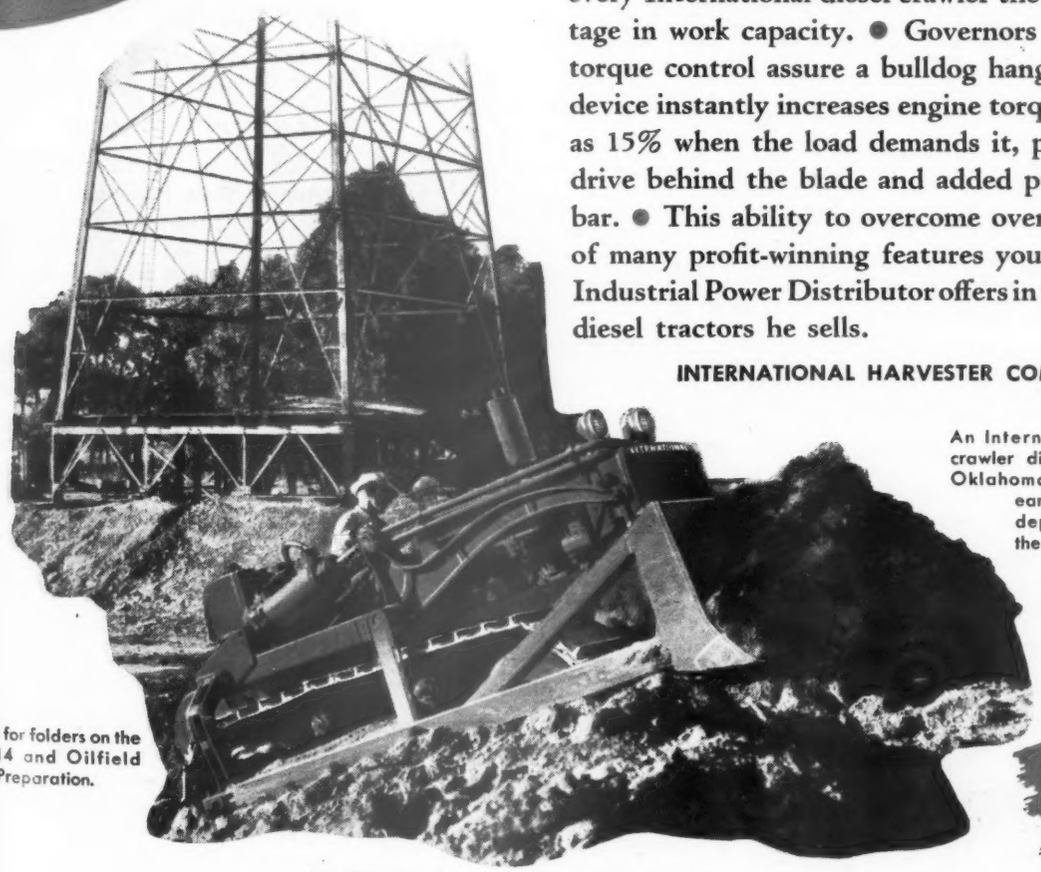

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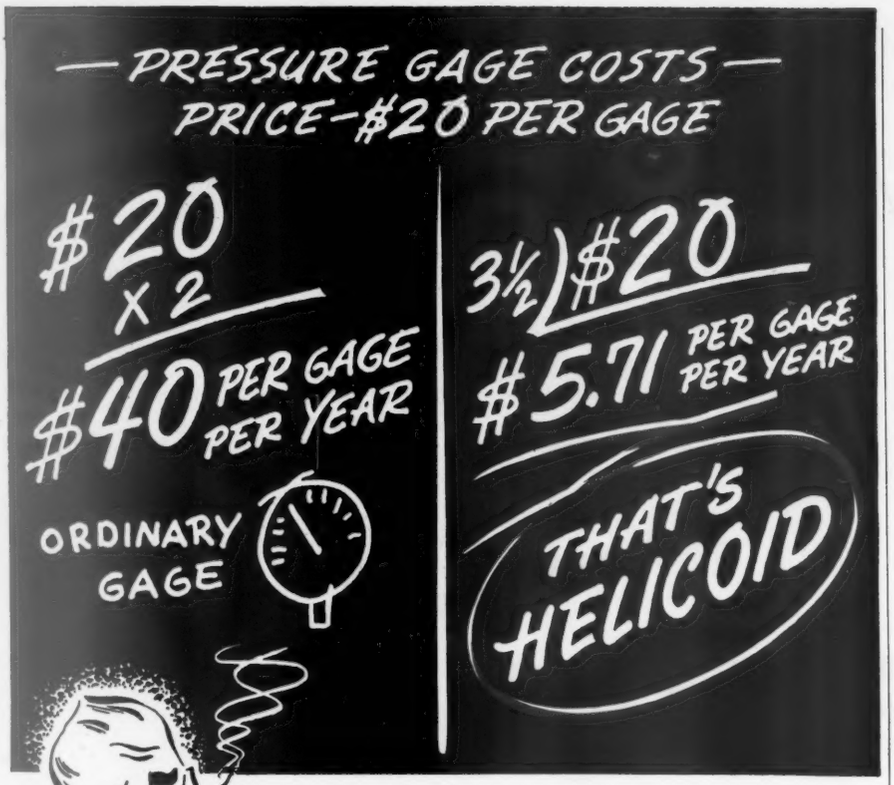

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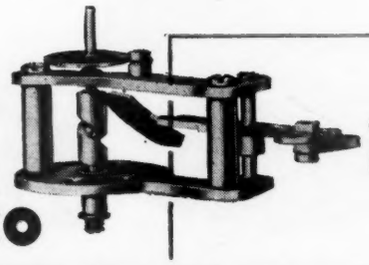

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LETTERS *to the Editors*

Pan American Congress

To The Petroleum Engineer:

I appreciate the interest shown by K. Marshall Fagin in the work of the First Pan American Engineering Congress, held in Rio de Janeiro, as I believe a fine understanding will be developed among the engineers of this country through future congresses.

The topics of a technical nature discussed during the First Congress did not relate directly to drilling for and production of petroleum. There were some discussions, however, on subjects that dealt with exploration methods. Apparently the greatest interest in regard to raw materials was in mining methods as applied to operations in this hemisphere.

W. H. Carson,
Dean, College of Engineering,
The University of Oklahoma,
Norman, Oklahoma.

Data Book

To The Petroleum Engineer:

I noticed an announcement of The Petroleum Data Book in one of your excellent magazines. I would very much like to know if it is possible to get a copy. I am at present with the Anglo-Iranian Oil Company and expect to depart for Iran shortly.

I would say in closing how much I enjoy reading your very interesting magazine.

P. Gregg,
Dover, Kent,
England.

Editor's Note: *A few copies of the second edition of The Petroleum Data Book are still available.*

Blending of Lubes

To The Petroleum Engineer:

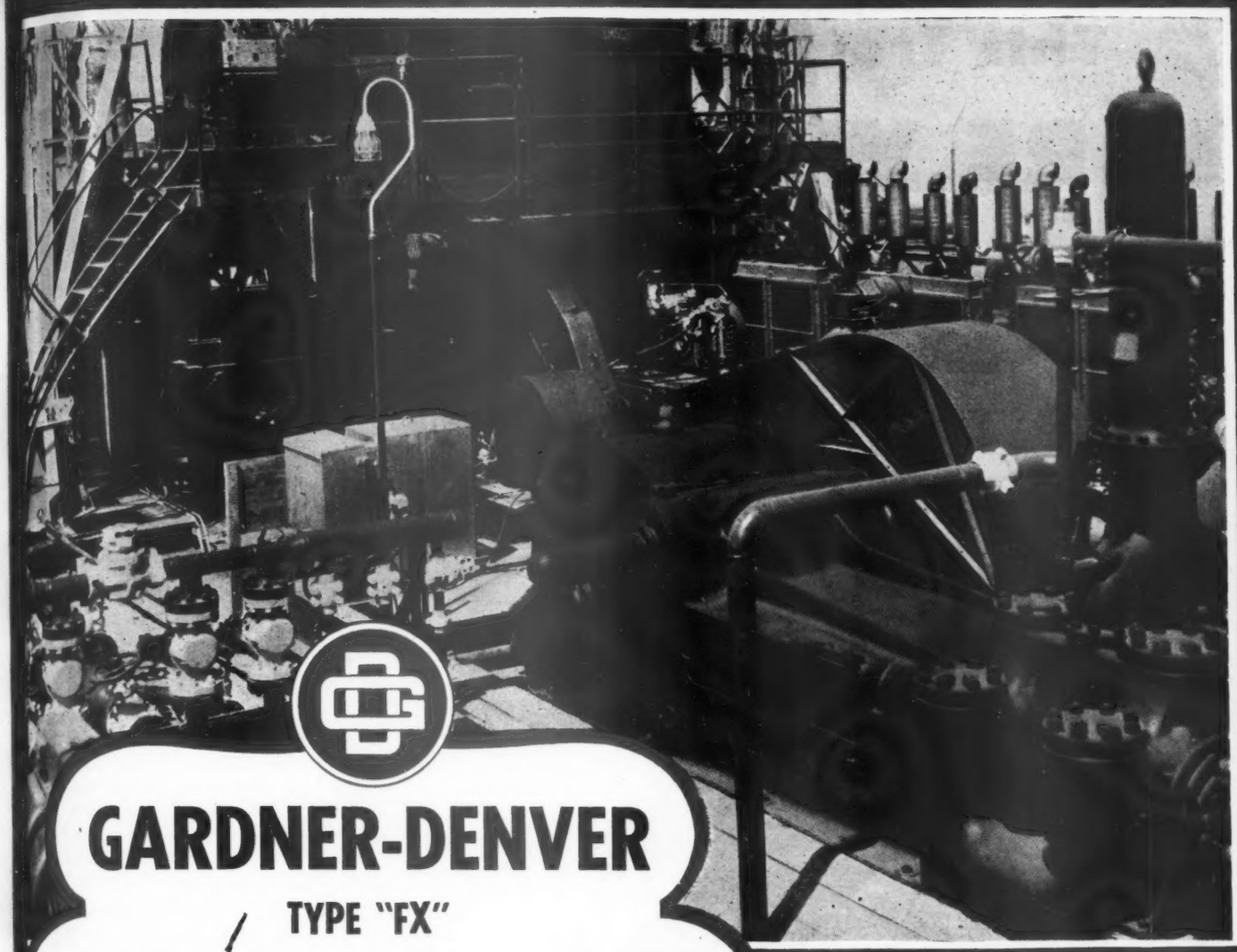
I have been in an argument about mixing oil. I would like to know if you can mix SAE 10 and SAE 30 oil to get SAE 20, and still be the same as the regular SAE 20 oil.

At your convenience, I would like to have information about this.

Robert M. Sanders,
Route 2, Box 30B,
Gladewater, Texas.

Editor's Reply: *It is entirely practicable to blend SAE 10 and SAE 30 oils and produce an*

UNIFORMLY BETTER



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An SAE 10 oil has a viscosity of up to 12,000 seconds Saybolt Universal viscosity at zero, F. An SAE 30 oil has a viscosity between 185 and 255 SUV at 130 F. Thus we see that their viscosities are not based on the same temperature and thus do not always 'jibe' at the same temperatures. It is possible to blend a very light SAE 10, of low viscosity index, with a very light SAE 30 and obtain an oil that is too light—low in viscosity—to meet SAE 20 viscosity limits. However, these conditions are abnormal and in general a 50-50 blend of 10 and 30 grades will result in an oil, intermediate in properties and specifications between the two blended, and meeting SAE 20 grade viscosity requirements. No other properties are specified in SAE grades than viscosity, not even viscosity index.

For your information, all Pennsylvania refiners, with possibly one or two exceptions, and many Mid-Continent lubricating oil refiners produce a light neutral oil and a heavy, undistilled bright stock, and from those all SAE grades, except possibly special oils exceptionally heavy or light, are made by blending these two in different proportions to obtain the oils of different viscosity ranges.

Airplane Crash

To The Petroleum Engineer:

I have your letter of September 12 addressed to R. Ross Patterson discussing the Dallas Field article in which you were both so interested.

Pat, together with his wife and son, were taken from us tragically on September 3 in the crash of their light plane. I am enclosing a clipping from the Wyoming State Journal of September 15 because I believe you would like to have it.

I know just how much the telling of the Dallas story would have meant to him and am so sorry that this letter could not rather be a transmittal of his manuscript.

Pat was proud, and justifiably so, of the job he had done. Under his supervision conversion to electric power and more modern treating methods was accomplished without the loss of a day's production. It is regrettable that he could not have seen his plans through to the end. Many men would have found too formidable the assignment to which he devoted so much of his time, talents, and energy.

William M. Hayes,
Thermo Petroleum Company,
Lander, Wyoming.

Editor's note: This seems to us a fine memorial, better than one of dates and places. R. Ross Patterson, a native Canadian, had spent most of his life in Wyoming and was a graduate of the state university. He had been with the U. S. Geological Survey. For the last five years he was field superintendent at Lander, Wyoming, for Thermo Petroleum Company.

Entrance to the Cartagena Refinery, Spain. *Photo courtesy Caltex*

Round Up of World Oil Activities

ERNESTINE ADAMS*

ECONOMIC demands only one short year ago put pressure on exploration and production of petroleum. As this goes to press, the pressure has shifted to refining and distribution to bring supply and demand into balance once more.

The efficiency and mobility of the petroleum industry indicates its good health. If supply is short, oil men swarm over the earth to find new deposits. If supply is long, up go oil refineries and chemical plants that make new products; pipe lines and tankers are built to carry the products to new places.

This does not mean that exploration is at a standstill—far from it. Geological and geophysical parties have travelled in the last year to the earth's corners and development drilling in many countries has been heavy.

But the stress is on construction of processing and distribution facilities. The oil industry reacts quickly to world conditions.

Imports to the U. S.—the world's largest market—have been a point of dispute but have fallen off in recent months.

In a recent report, "Petroleum and the European Recovery Program," August, 1949, the effect of the ERP on the petroleum industry was given.

Below are oil activities in various countries. Current production rates and refining capacities, (sometimes estimates, as in Russia, Romania, etc.) precede a brief account of late developments. No attempt is made to give a background of the industry in these various countires. The report here follows those of previous years and all combined make up a short history of modern oil developments.

EXCLUSIVE

Albania

Prod. 900 B/D **Ref. Cap. 750 B/D**

So far as is known the small oil fields at Devoli and Pahtoso have continued a production drop with no new development work. Figures are under 1000 bbl a day production with the oil refined nearby.

Alaska

The Navy's oil exploration in its Petroleum Reserve No. 4 in Arctic Alaska continued throughout the fiscal

*Managing Editor.

year. Drilling, geophysical survey work, and administration is being carried on for Navy under civilian contract while the U. S. Geological Survey is doing the surface geology, paleontology, and core analysis. Funds to carry on are provided for in the Navy 1950 appropriations and estimates for continuing the work will be contained in the figures submitted with naval estimates for fiscal year 1951. Dry gas from a discovery made in Barrow No. 3 well in 1949 has been piped some six miles to Navy's Barrow camp for fuel. Potential production from this well is estimated at 3,000,000 cu ft daily while maximum consumption probably will reach about 300,000 cu ft daily in winter. Three strings of tools were engaged in drilling in the Reserve and a light rig is being used in core drilling near the Cape Simpson seepages.

Algeria

The National Society for Petroleum Research and Exploration in Algeria (S. N. Repal) has conducted explorations throughout the whole Algerian territory since July 1948.

On the plains of Cheliff (Province of Oran) several deposits have been recognized through drilling. At the present time soundings are being conducted in the Aumale region (Province of Alger), which are producing small quantities of oil.

In the year ending June 30, 1949, the S.N. Repal has drilled altogether approximately 11,600 meters (about 35,000 ft). The deepest drilling was 2400 meters (about 7300 ft) on the Plains of Cheliff.

Argentina

Prod. 63,000 B/D **Ref. Cap. 125,000 B/D**

Yacimientos Petroliferos Fiscales (Y.P.F), the government oil company, has been hampered the past year by lack of funds and is presently operating on a rather restricted program. Production in the country is approximately 60,000 bbl daily and consumption is 90,000 to 100,000 bbl.

The 10-in. gas line from the Comodoro Rivadavia field to Buenos Aires is approximately 50 per cent complete and construction is moving slowly because of the shortage of tubular goods.

Drilling and Exploration Company, Inc. of Dallas, Texas, which has a contract to drill 40 wildcat and producing wells for YPF, is now drilling on the first two wells in western Argentina to the south of Mendoza.

Australia

Refining capacity 20,000 B/D*

No oil has yet been found in Australia but surveys and test drilling continue. Operating in 1948 were 56 geological surveys, 8 gravity and 8 magnetic surveys.

The new Melbourne refinery of Vacuum Oil Company, Pty., Standard Vacuum affiliate in Australia, began operations in July 1948 and is now processing 1400 bbl per day of crude oil.

*Including shale oil refinery.

Austria

Prod. 15,000 B/D **Ref. Cap. 18,000 B/D**

The operation and development of producing fields in the Russian Zone of Occupation and the production of Austrian crude oil has been under the control of the Soviet Government since the close of the last war. The Soviet Oil Administration is reported to be operating 25 to 30 rigs, mostly in development wells. Wildcatting resulted in one wild gas well that buried the whole rig in a crater. In the United States Zone of Upper Austria the Rohoelgewinnungs, A.G., jointly owned in equal proportions by Socony-Vacuum and The Royal Dutch-Shell, commenced geologic mapping and core-hole drilling in the exploration of the Alpine foreland.

Acknowledgment

Information for this article was obtained through the generous help of companies holding concessions in foreign countries and through national officials in charge of petroleum affairs in the nations of the world. The only countries not heard from were those under Soviet influence.

Bahamas

All operating companies except Shell Company of Bahamas renewed their exploration licences for 1949, and part of the area relinquished by Shell was re-allocated to Bahamas Exploration Company (Gulf). Little field work has been done during the year 1949 but all companies have been occupied in interpreting the results of the surveys carried out in 1947 and 1948.

Bahrein

Prod. 30,000 B/D **Ref. Cap. 178,500 B/D**

The Bahrein Petroleum Company Limited (Caltex) has underway an extensive construction program in Bahrein, Persian Gulf, which is designed to provide a well balanced refinery at the present level of crude throughput. A new thermal reformer and auxiliary facilities have just been placed in service, bringing the reforming capacity of this refinery up to 21,000 bbl per day. An 18,000-bbl per day vacuum unit, which will charge atmospheric reduced crude, will be brought on stream this month. A 55,000-bbl per day crude unit will be ready for service during the latter part of 1950 and will replace equipment that is at present temporarily in crude processing service.

Tankage is being erected to bring storage capacity up to a satisfactory level at present operating rates.

Power facilities are being expanded by the provision of two boilers and two turbo-generators. The first units of this equipment are now being tested and the remainder will be ready during the early part of 1950.

A new laboratory, additional office space and more housing units for employees are being provided in this program.

The Bahrein field is producing about 30,000 bbl daily.

Belgium

Refining capacity 19,000 B/D

It was announced September 7, 1949, a new company, the Esso Standard Refinery, has been formed to construct and operate a refinery of about 25,000 bbl per day capacity at Antwerp to supply products to Jersey Standard's affiliates in Belgium, the Netherlands, and Luxemburg. Construction will take three years, it is estimated.

Another plant of similar size is being constructed at Antwerp by Soc. Industrielle Belge des Petroles, S.A.

Bolivia

Prod. 2200 B/D **Ref. Cap. 2000 B/D**

Yacimientos Petroliferos Fiscales Bolivianos continued during the past year the execution of the program to develop a supply for the internal consumption of liquid fuel.

During the mentioned period the total drilled was 3706 meters, having completed the drilling of 7 wells. Actual production of Camiri was much less than potential, due to the fact that the program of drillings in this district was planned after the completion of the Camiri-Cochabamba pipe line. From July 1, 1948, to June 30, 1949, production of petroleum reached 88,393 cubic meters. (Approximately 530,000 bbl.)

Geological activities by Y.P.F.B. during the preceding year has particularly united the two zones, "Los Monos" and "Izozog," where outcrops have been found and traces of petroleum, which make the area economically interesting.

The petroleum manufactured in the refineries of Camiri and Sanandita, from July 1, 1948, to June 30, 1949,

reached 73,799 cubic meters. (Approximately 450,000 bbl.)

The pipe line Camiri-Cochabamba (327 miles) branch line to Sucre (44 miles) was inaugurated officially August 16, 1949. It was constructed by the Williams Brothers Company of Tulsa.

Borneo (Neth.)

Prod. 20,000 B/D **Ref. Cap. 8500 B/D**

Shell's operations here have been largely rehabilitation so far. Production has increased as wells have been cleaned out and fields put on more efficient production operations. The Indonesia-Dutch conflict did not reach Borneo to hamper work.

Brazil

Prod. 400 B/D **Ref. Cap. 37,000 B/D**

Conselho Nacional do Petroleo is the government organization of Brazil charged with the development of the petroleum resources of that country. This organization commenced work 10 years ago and has now brought into production one considerable oil field, one good small field and three very small oil fields. Production rose from 97,000 bbl in 1947 to 143,000 in 1948. Three gas fields have likewise been found. These developments are all within the state of Bahia and within a radius of 30 miles of the city of Salvador, which is the capital of the state.

Since its inception oil producing operations, and pilot plant refinery operations have been conducted for the Conselho by Drilling and Exploration Company, Inc. of Dallas, Texas. DeGolyer and MacNaughton, likewise of Dallas, has been in charge of exploration geology for the last four or five years.

The Kellogg Company has the contract to build a 2500-bbl refinery with cracking unit near the city of Salvador. Other refineries are planned.

Brunei

Production 65,000 B/D

British Malayan Petroleum Company has stepped up its production at the rich Seria field, only field in this small British protectorate on Borneo island. Some 145 wells produced more than 18,000,000 bbl in 1948, a one-third increase over 1947.

Burma

Prod. 500 B/D **Ref. Cap. 2000 B/D**

Political unrest hinders any development here. The largest refinery, Burmah Oil Company's Syrian plant, is not yet ready for full operation. It has 20,000 bbl refining capacity.

Canada

Prod. 55,000 B/D **Ref. Cap. 325,000 B/D**

The most outstanding development in the world during the last year was in Canada's Alberta Province. U. S. companies have gone into the area by the dozens and a boom is on. Canada's laws covering petroleum development are similar to those of the U. S. and there has been no hesitancy on the part of the large and small companies to add to the stake. When Imperial Oil found the Leduc field in February, 1947, it opened the greatest producing area since East Texas.

Imperial Oil Limited

Producing Operations. Concurrently with the development of the Leduc and Woodbend fields, Imperial Oil continued its wildcat operations in Alberta during the last year. In August 1948 the Redwater field was discovered some 35 miles northeast of Edmonton. Two step-out wells indicated that the field was nearly 10 miles long. It has been termed "the most important oil discovery in the western hemisphere during 1948." Since that time, 156 wells have been drilled in the field —39 by Imperial and 117 by other operators. At Leduc-Woodbend Imperial has completed 152 producing wells since July 1948.

On February 10, 1949, Imperial's Schoepp No. 1 well, about 22 miles southwest of Edmonton, found oil. Subsequent coring and testing revealed 545 ft of porous oil-bearing formation. This is the greatest thickness discovered to date in Canada. On a brief production test the well flowed at a rate of 10,000 bbl per day. The field has been named Golden Spike after a nearby hamlet.

On March 28, Imperial Bon Accord No. 1 found oil 20 miles north and east of Edmonton and on April 17 Imperial Whitemud No. 1 came in as a discovery 12 miles south of Edmonton.

Oil was also discovered under farm-out agreements on Imperial holdings at Barrhead, 55 miles northwest of Edmonton, and at Joseph Lake, 20 miles southeast of Edmonton, and at Bon Accord, 20 miles northeast of Edmonton.

Refining. Imperial Oil's Edmonton refinery went into operation in July 1948 with a capacity of 6000 bbl per day. The installation of additional equipment has recently been completed to increase capacity to 15,000 bbl per day. This was the Whitehorse refinery that was moved to Edmonton from 1350 miles away piece by piece by rail, ocean, and over the Alaska highway. The nearby Leduc Field will supply this relocated refinery.

The $20,000,000 modernization program at Imperial's Montreal East refinery was completed during the latter part of 1948. This project included a 13,200-bbl per day crude distillation unit, an 11,000-bbl per day fluid catalytic cracking unit, a 4200-bbl per day catalytic polymerization plant and a light ends unit. Additional tankage and auxiliary equipment was also installed. The refinery now has a capacity of 37,000 bbl per day.

Transportation. In October 1948 an 8-in., 17-mile pipe line went into operation carrying oil from Nisku (rail terminus of the Leduc-Nisku pipe line) to Imperial's Edmonton refinery.

In October 1948 Imperial received delivery of the lake tanker Imperial Sarnia. This ship has a capacity of 56,000 bbl and is the largest tanker ever built in a Canadian shipyard.

A 228,000-bbl supertanker, The Imperial Alberta, was added to Imperial's ocean fleet in the spring of 1949. It is now in service bringing crude to the company's refineries in Quebec and Nova Scotia.

Socony-Vacuum Oil Company. Three dry holes were drilled. Craigmyle No. 1 encountered good shows in the Madison limestone but attempts to put the well on production failed. Subsequently, Craigmyle Nos. 2 and 3 were drilled, found to be dry and were abandoned. A fourth well in the McKee Lake area, Morrin No. 1, was spudded on July 2, 1949. Seismic and gravity parties were engaged in the exploration of the area centered around Calgary and southwest of Hanna to the International Boundary.

Gulf Oil Corporation. In Alberta, Canada, where the company has an active exploratory program, a gas-distillate well was completed early in 1948 as the discovery well of the Pincher Creek field, about 20 miles north of Glacier National Park. Two additional test wells are being drilled to determine the extent of the discovery. Several other wells drilled in Gulf's extensive acreage holdings in the Edmonton area were unsuccessful, but additional tests are being made.

Chile

Prod., shut-in **Ref. Cap. 300 B/D**

Corporación de Fomento de la Producción, government-company with sole rights in Chile, expanded the Springhill field to 8 oil wells and 6 gas wells, all shut in. A pipe line from the field to the Gente Grande Bay on the Straits of Magellan, a distance of 43 miles, will permit the only oil field in Chile to be opened up.

China

Prod. 1000 B/D **Ref. Cap. 7000 B/D**

Despite their insignificance from the world's standpoint, the small fields of China are locally very important because of the scarcity of goods and resources in the north provinces. Chinese fields, which are now in Communist hands, probably do not pro-

duce more than 1000 bbl a day.

Refineries in Communist-held China are said to be running far under capacity or shut down because of crude oil shortage.

Colombia

Prod. 83,000 B/D **Ref. Cap. 23,500 B/D**

Tropical Oil Company, during the period July, 1948, to June, 1949, drilled six deep tests of which five were completed as dry holes. The remaining well is still drilling. Five power rigs were used in the exploratory drilling program. No exploitation drilling was done in the De Mares Concession. An active exploratory program was carried out by the Geological Department.

The four producing fields of the De Mares Concession (La Cira, Infantas, Colorado and Galán) produced 10,454,921 bbl of crude and 721,628 bbl of natural gasoline, petroleum condensate and liquified propane gas. The Barrancabermeja Refinery had a total crude throughput of 7,137,739 bbl or a daily average of 19,555 bbl. A total of 32,529 bl of Velásquez crude produced by the Texas were also processed in the refinery. Exports of crude oil for the period amounted to 6,007,249 bbl. This oil was transported by the Andian National Corporation through its pipe line from El Centro to Mamonal on the Caribbean sea.

The production figures show an increase over the previous period due to the fact that the company was free of major labor trouble. Considerable work was done in recompleting and reconditioning wells mainly by opening up producing sands cased off in the original completion. As a result of this work the normal decline rate in production has been minimized.

A 6-in. products pipe line from Barranca to Cantimplora, some 90 kilometers southwest of Barranca, completed late in December of 1947 operated normally throughout the period. This pipe line has been an effective factor in maintaining a normal flow of refined products for distribution throughout the country, specially during the dry season when the low water level in the Magdalena River makes navigation extremely difficult.

A material terminal and warehouse were completed in Barranquilla to serve as a receiving and distributing center for all operations in the country.

Tri-Pet Corporation (Sinclair, Cities Service, Richfield) has suspended operations and withdrawn from Colombia.

In a joint operation Socony-Vacuum and Shell, drilled four wildcat wells on the Cimitarra concession all of which were dry holes. Two wildcat wells were spudded prior to July 1949; one a stepout on Cantagallo and the other 10 kms northwest of Cantagallo field. The latter is Paturia No. 1, also a joint operation of Socony-Vacuum and Shell.

The Texas Company and Socony drilled El Jobo No. 2 in the Coastal area, which gave only some gas shows after reaching basement at 7490 ft. Sahagun No. 1 was carried to TD 10,012 ft without any significant showings, and the adjacent concessions were released.

In the Caqueta area, three stratigraphic tests were completed by The Texas Company: La Rastra No. 1 and Curbinata No. 1 on the Puerto Diago concession were drilled slightly over 3000 ft, and Jose Maria No. 1 on the Canunguchal concession was drilled to 5553 ft. As the findings were negative, the concessions were released.

In the Velasquez field Texas completed well No. 6 for about 350 bbl per day of 28.4 gravity oil, and a location was made for well No. 7. Output is put on barges for delivery to Tropical's refinery at Barrancabermeja, down the river.

In Tolima, Tetuan No. 1, wildcat, 575 miles from Caribbean tidewater, was drilling in Cretaceous formations at 1356 ft at end of July.

Cuba

Prod. 300 B/D **Ref. Cap. 6000 B/D**

The Cuban Gulf Oil carried on exploration activities including drilling. Production in old fields has dropped sharply despite some development drilling.

Czechoslovakia

Production 600 B/D

Small production here grows smaller from accounts that leak around the rivets of the iron curtain. About 600 bbl a day is recent estimate of production.

New Zealand Strike

The first crude oil has been found in New Zealand, according to a report in *The Petroleum Times*. The first well was sunk by New Zealand Oil Refineries. The well is reported to have produced 6000 gal of crude oil from 2222 ft in a 24-hr test. It is about 140 mi south of Auckland in the southwest part of North Island at Moturoa, New Plymouth.

About 1000 yds from this discovery a second location has been selected for drilling. The local refinery capacity is 1000 gal a day, but is being increased.

Denmark

Refining 600 B/D

Danish American Prospecting Company, a wholly owned subsidiary of Gulf Refining Company, has operated during the year: (1) One large Emsco rig that drilled Gassum No. 1, 10 miles north of the city of Randers. Now standing idle. Total depth 9955 ft; (2) one semi-portable Cardwell rig, which has been used for deeper core-holes and salt tests; (3) one truck mounted Sullivan rig, which has been operated continuously for core-holing; and (4) one seismograph crew, which has been doing reflection and refraction shooting.

Ecuador

Prod. 7500 B/D **Ref. Cap. 5700 B/D**

Anglo-Ecuadorian Oilfields, Ltd. continues to develop the Ancon area, largest producing field in the country.

Shell and Standard (Ecuador), S.A. are prospecting in the Oriente region. Half the 20 million-acre concession has already been released.

Political and labor troubles hinder development but in spite of these production has increased and is about 7500 bbl a day, total for all fields.

Egypt

Prod. 42,00 B/D **Ref. Cap. 41,000 B/D**

Asl field was placed on production in February 1949 and is producing 5500 bbl a day of 22 gravity oil from Eocene limestone at an average depth of 3800 ft. Asl was discovered in early 1948 by a Socony-Vacuum, Shell, and Standard Jersey combination. It is 16 kms south of the Sudr field. Geologic and geophysical parties were engaged in the exploration of the Gulf of Suez area.

Eire

Refining capacity 600 B/D

Cork Harbour Oil Wharves, Ltd. operates the only refinery in the South of Ireland.

England

Prod. 900 B/D **Ref. Cap. 120,000 B/D**

No new fields have been discovered by the limited wildcatting in England. Production continues to be about 900 bbl a day.

Important story in United Kingdom is the expanding of refining capacity.

During the next three years, the refinery at Fawley, owned by the Anglo-American Oil Company, a British affiliate of Standard Oil Company (New Jersey), will be enlarged to process 110,000 bbl per day. This expanded plant, estimated to cost $150,000,000, will process Middle East crude for gasoline, kerosine, gas and diesel oils, heavy residual fuel oils, asphalts, and certain specialty products.

Ethiopia

After surface geological explorations Sinclair is now engaged in the drilling of a deep well in the Gumburo Hills district of the Ogaden. Geophysical surveys are also being carried on in eastern Ethiopia.

Formosa

Prod. 100 B/D **Ref. Cap. 10,000 B/D**

The Chinese Petroleum Corporation, Nationalist government company, is concentrating its efforts now on Formosa's small fields, which may produce 100 bbl a day total by now, and refining facilities.

France

Prod. 1100 B/D **Ref. Cap. 290,000 B/D**

In the course of 1948 the research works were essentially concentrated in the southwest where three companies are working. Broad geophysical surveys, with recourse to gravity, magnetic and seismic processes, were on their way, and set up a general gravimetric map for the Aquitaine and Languedoc basins. Moreover, 20 powerful rigs and 5 light rigs were continuously in operation.

The most part of the wells, completed in the course of the year, went down to more than 7000 ft, so that the 26 wells completed in 1948 drilled a total of 140,000 ft, which is 20 per cent more than in 1947.

With the exception of two extensive wells in St. Marcet area, all the other holes were wildcats. Some of them brought up gas and oil shows that are encouraging for the future of the exploration.

The production obtained in the Aquitaine Basin came from the St. Marcet's condensate gas field, which produced 6500 million cubic feet of gas, 11,200 tons of products and 12,500 bbl of oil in 1948.

In the other parts of France some preliminary works are also to be mentioned, in Jura and Provence. Finally, in the Alsace basin, Pechelbronn Company, who had first rehabilitated its plants (badly damaged during the war), explored again the neighborhood of the present field and the Mid-Alsace. Thirty-nine wells were completed in 1948 in the Pechelbronn area, totaling 100,000 ft drilled. The production of the Pechelbronn oil field reached the prewar level, with an average of 1000 bbl per day.

Activities in the French refining industry during the period from January, 1948, to July, 1949, are shown in the following tables. The first one gives the imports of crude oil and the volume processed in French refineries.

Millions of Barrels

	1938	1948	1st half of 1949
Imports	51	61	43.5
Processed	50	60.5	41

Because of the geographical location and the outstanding oil development of the Near East the oil supply for refineries is coming more and more from Middle East production. The table below shows the proportion of petroleum that comes from the different sources.

Millions of Barrels

	1938	1948	1st half of 1949
Middle East	45.1%	70.3%	83.6%
United States	33.3%	4.5%	0.4%
Other American Countries	20.3%	24.6%	15.5%
Europe	1.3%	0.6%	0.5%

Plant management has been following a pre-arranged plan for the years 1948 and 1949. The annual throughput capacity of 11 refineries are progressing as shown below:

Processing Capacity, Bbl

	Annual	Daily
January 1, 1938	59,500,000	180,000
January 1, 1948	52,800,000	160,000
January 1, 1949	89,300,000	270,000
July 1, 1949	95,000,000	290,000
January 1, 1950	103,000,000	310,000

The above expansion is caused by placing in service two reconstructed refineries, one at Ambes and another at Dunkerque.

Besides production of motor fuel in this country the following are also products of French refining:

	1948	1st half of 1949
Natural Gasoline	100,000 bbl	45,000 bbl
Crude oil	400,000 bbl	190,000 bbl
Shale oil products	120,000 bbl	52,000 bbl
Synthetic oil products	60,000 bbl	15,000 bbl

In line with the general program for rehabilitating and expanding the

Sinclair Oil Company was able to carry out its exploration work in Ethiopia during the last year and begin drilling its first well. At right is No. 1 Gumboro.

Below, Emperor Haile Selassie of Ethiopia puts into motion the machinery for drilling the first well in his country. Sinclair has already spent millions for exploration in the northwest African empire.

Port Jerome refinery, a Standard Jersey affiliate plans to construct a 1200-bbl-a-day propane dewaxing plant and a 1800-bbl-a-day propane deasphalting plant to permit increased production of the higher quality lubricating oils.

French Equatorial Africa

In the French Equatorial Africa region, known as Gabon Basin, the French government has drilled two exploration wells and plans others.

Germany

Prod. 17,000 B/D **Ref. Cap. 90,000 B/D**

Drilling activity centered in the Hannover Basin where a number of salt dome flanks were drilled without encouraging results. Geophysics has outlined a number of interdomal structures one of which was drilled and found to contain light oil. This well is Suderbruch No. 1, a Socony-Vacuum discovery. Exploration of the Oldenburg concession to the northwest of Hannover was carried on with gravity, seismic reflection, and core-hole drilling continued. Production in 1948 was increased 15 per cent over the previous year with the development of existing producing wells in the Hannover area. Daily average output is some 13,000 bbl.

Consideration is being given by Jersey Standard to expanding the present 13,000-bbl-a-day refinery at Harburg in order to insure that the needs of its German affiliate will be fully met with locally refined products.

Guatemala

Standard of Ohio, Atlantic Refining, and Ohio Oil Company conducted surveys. Sohio was reported interested in exploration drilling if a satisfactory contract could be made in the face of Guatemala's restrictive laws.

Hungary

Prod. 9000 B/D **Ref. Cap. 23,000 B/D**

The Hungarian Soviet Oil Company, which now manages the oil fields taken from the Standard Jersey subsidiary in September, 1948, appears to be unable to keep up production with seven old rigs for drilling. Output is under 10,000 bbl a day. Exploration has been limited; no new oil fields were discovered but a small gas deposit was found.

India

Prod. 5000 B/D **Ref. Cap. 5500 B/D**

Burma Oil Company, Ltd. has been operating three rigs on exploration but have not reported any strike. The Digboi area produced almost two million barrels of crude oil in 1948, a slight increase over 1947.

Iran

Prod. 560,000 B/D **Ref. Cap. 574,000 B/D**

Anglo-Iranian crude oil production in Iran averaged 523,000 bbl per day in 1948 and is currently running at about 560,000 bbl per day. A new 20/22-in. line was commissioned in April running from the Agha Jari field to Bandar Mashur where additional piers and facilities are under construction. After lengthy negotiations an agreement was recently signed between the Anglo-Iranian Oil Company and the Imperial Iranian Government whereby the latter would receive increased royalty payments. This agreement still awaits ratification by the Iranian Majlis.

Abadan refinery is currently processing approximately 525,000 bbl per day.

Iraq

Prod. 97,000 B/D **Ref. Cap. 9500 B/D**

Iraq Petroleum Company, Ltd. The Kirku field has produced from July 1, 1948, to June 30, 1949, 2,458,078 tons of crude oil. Cumulative production to June 30, 1949, is 52,945,616 tons. The company completed four observation wells during the year and two observation and two production wells were in progress at the end of the period.

The 12-in. pipe line from Kirkuk to Tripoli was operated throughout the year, but the line from Kirkuk to Haifa has been closed since July 1948.

The 383 miles of 16-in. pipe line were laid from K.3. pump station (near the Euphrates crossing) to Tripoli. In July 1949 this was tied-in to the 16-in. line previously laid from Kirkuk to K.3. as part of the projected Kirkuk-Haifa line and test pumping commenced in July. When complete the capacity of the Kirkuk-Tripoli 16-in. line will be 90,000 bbl per day.

Mosul Petroleum Company, Ltd. Four exploitation wells were drilled in the Ain Zalah field and three wells were in progress at the end of the period. This field has not yet been placed on a production basis.

Basrah Petroleum Company, Ltd. Two exploration wells were completed, both of which proved the presence of oil in the Cretaceous strata of the Basrah area. These discoveries have not yet been completely evaluated, and three more exploration wells are in progress.

Italy

Prod. 200 B/D **Ref. Cap. 70,000 B/D**

Stanic, a new Italian oil-refining company, jointly owned and operated by Standard Oil Company (New Jersey) and the Italian-owned company of Anic, has determined to modernize its refineries at Leghorn and Bari, Italy. At the present time, the combined capacity of the two plants is approximately 16,000 bbl per day but eventually it is to be increased to approximately 40,000 bbl per day.

Caltex and Fiat Company of Turin plan to construct a refinery in the Po Valley, with an initial capacity of 10,000-bbl per calendar day. The operating company, already organized and known as Sarpom (Societa per Azioni Raffineria Padana Olii Minerali), will process Arabian crude supplied by a pipe line connected to a coastal terminal at Savona, in the vicinity of Genoa. The refined products will be marketed primarily throughout the industrial centers of northern Italy.

Caltex investments in Sarpom and Petrolcaltex are an integral part of a general program of expansion of activities in Europe and the Mediterranean area.

Japan

Prod. 3500 B/D **Ref. Cap. 32,000 B/D**

A new deep production zone was reported by General MacArthur's headquarters in July. It is situated in Yabase, Honshu, and is said to be one of the richest deposits yet found in Japan.

Java

Prod. 1000 B/D **Ref. Cap. 16,500 B/D**

Political conflict has held off development and rehabilitation.

Kuwait

Production 230,000 B/D

Kuwait Oil Company, Ltd. (Gulf and Anglo-Iranian) has squeezed back production because of heavy world supplies. The tremendous Burghan field could produce more and has gone to almost 300,000 bbl a day. Some exploration work is being done on the concession.

Lebanon

One exploration well was completed and abandoned by Lebanon Petroleum Company, Ltd.

Mexico

Prod. 164,000 B/D **Ref. Cap. 163,000 B/D**

The large question in Mexico is how the government monoply, Pemex, can finance development of oil and gas resources. President Truman favors a U. S. loan, which most oil companies think is unnecessary. A long strike by Pemex employees has not helped the development program.

Morocco

Production 250 B/D

New discoveries in the Oued Beth area increased production for Soc. Cherifienne de Pétroles, French government-owned company. Production at Oued Beth is limited by lack of transportation facilities.

Netherlands

Prod. 11,500 B/D **Ref. Cap. 60,000 B/D**

Nederlands Aardolie Maatschappi, owned equally by Royal Dutch Shell

Iraq Petroleum's administration building, left, and the marine station, right, at the great Tripoli Terminal.

and Standard Jersey, carried on a fairly heavy development program at Schoonebeek field. Production now runs approximately 11,500 bbl a day, three times what it was in 1947. Some encouragement was given by exploratory drilling. Gas was discovered below 9000 ft nine miles west of Schoonebeek and oil shows in a junked well near Delft forecast a shallow field.

Nicaragua

Exploration by the American International Fuel and Petroleum Company, which is participated in by Gulf Corporation and The Atlantic Refining Company, was limited to a few weeks of airborne magnetometer work over the Atlantic coastal lowlands. Operations are presently suspended.

Norway

Rehabilitation work on the Vallo refinery is proceeding and it is expected that by the latter part of 1950 it will be processing 1000 bbl a day of low cold test crude oil for white products, asphalts, and lubricating oils.

Netherlands West Indies

Refining Capacity 627,000 B/D

The reduction in demand towards the end of 1948 and beginning of 1949 caused a decrease in the crude runs at the Lago Oil and Transport Company, Ltd. refinery at Aruba, N.W.I. The year 1948 saw Aruba's first production and shipment of propane.

The Curacao refinery has a 200,000-bbl capacity a day, which with the Aruba plants of Lago and of Arend Petroleum Mij., account for the large capacity.

Panama

Sinclair Panama Oil Corporation completed two dry holes in Panama and the company has withdrawn from that area.

Paraguay

Union Oil Company of California is presently moving in to its fifth wildcat location on its 56,000,000-acre concession in this country. The fourth well was completed recently and the move was made over the 200 miles of road constructed between the two locations. Four dry holes have been drilled and the fifth well is testing the southeastern portion of the area. These operations are being carried out for Union by Drilling and Exploration Company, Inc. of Dallas, Texas.

Philippine Islands

Oil was found on the Bondoc Peninsula by the Philippine Oil Development Company at 1750-2229 ft. Whether the reservoir can be developed commercially is not known.

Peru

Prod. 40,000 B/D **Ref. Cap. 34,500 B/D**

International Petroleum Company. Largest operator in Peru is International Petroleum Company, which operates La Brea and Pariñas concessions and the refinery at Talara. Crude oil production in 1948 was the second largest in history of the firm, amounting to 12,334,304 bbl including natural gasoline. The Talara refinery has been stepped up to process 32,500 bbl a day.

Compañia de Petroleo Ganso Azul, Ltda. This is the only company producing crude oil in commercial quantities east of the Andes Mountains in Peru. Up to the present time there has been drilled a total of 8 wells on the structure 6 of which are good producers, one a bad completion and one a dry hole. The 6 wells, which average approximately 1100 ft in depth, have a total potential production of some 6000 bbl per day of 43.9 API paraffin-base oil.

At the present time the field is producing approximately 500 bbl per day with all of the production being charged to the company-owned skimming plant situated on the concession.

The refined products of gasoline, kerosine, deisel fuel, and residual fuel oil are being transported by a fleet of 6 company-owned towboats and barges, distributed throughout eastern Colombia, and northeastern Brazil.

The company is at present planning a possible expansion of its facilities to include the exportation of crude oil to several of the neighboring South American countries.

During 1948 the Concession Agua Caliente produced 121,051 bbl of oil with the first 6 months of 1949 showing an increase of approximately 30 per cent over the same period of 1948.

Agua Caliente 1949 crude production by month.

Agua Caliente 1949 crude production by month.

January	11,462 bbl
February	11,022 bbl
March	14,521 bbl
April	10,705 bbl
May	16,850 bbl
June	19,546 bbl
Total	84,106 bbl

Poland

Prod. 3000 B/D **Ref. Cap. 14,500 B/D**

In 1909 Poland had its greatest oil production, more than 40,000 bbl a day. In the last year output went past the 3000 bbl daily mark. Russia took the largest fields by the East Poland Annexation. Drilling has been stepped up by the Liquid Fuel Industry and reports were made of several discoveries. A synthetic gasoline industry, using coal, is planned in order to cut the large oil imports.

Portugal

Refining capacity 10,000 B/D

Since July, 1948, several structures have been studied in the Lisbon region, northwest of this city and in the Province of Algarve, in the south

of Portugal. These works are being carried out by the experts of the Exploration Contractors, Inc., of New York, for the account of Companhia dos Petróleos de Portugal, which has the monopoly of exploration. This company intends to drill a stratigraphic well at the northwest of Lisbon and to have a seismograph work performed at the Tertiary Basin of the river Tagus.

Qatar

Petroleum Development (Qatar) Ltd. drilled four exploitation wells and two were in progress at the end of the period.

The laying of a 14-in. pipe line from the Dukhan field to Umm Said (on the east coast of the Qatar Peninsula) was begun.

Romania

Prod. 83,000 B/D **Ref. Cap. 140,000 B/D**

Reports from this Soviet satellite are contradictory and unreliable. A good proportion of the output goes to Russia and whether depletion is being held off with sufficient drilling is doubtful. The Economic Plan for this year called for 48.2 per cent more exploratory drilling.

Sarawak (Brit.)

Prod. 2000 B/D **Ref. Cap. 36,000 B/D**

On the island of Borneo the British-owned field, Miri, is increasing its production with more drilling.

Saudi Arabia

Prod. 455,000 B/D **Ref. Cap. 140,000 B/D**

Crude oil production in Saudi Arabia during August amounted to 14,113,731 bbl, or an average of 455,282 bbl per calendar day according to the Arabian American Oil Company.

Crude processed at the company's refinery at Ras Tanura amounted to 4,030,163 bbl, or an average of 130,005 bbl per calendar day.

Crude oil production for the first eight months of 1949 amounted to 118,580,554 bbl, an average of 487,986 bbl per calendar day. Crude run in the refinery for the same period was 32,805,742 bbl, an average of 135,003 bbl per calendar day.

Standard Oil Company (New Jersey) purchased a 30 per cent stock interest in the Arabian American Oil Company for $74,133,000, thereby acquiring an equivalent interest in the Trans-Arabian Pipe Line Company. This company has under construction a 30 to 31-in. diam pipe line from the Persian Gulf to the Mediterranean Sea. During 1948, 148 miles of the 1100-mile line was installed. When the line is fully completed (anticipated late 1950) Saudi Arabian crude can be delivered to the eastern Mediterranean at considerable savings over tanker transportation cost.

Scotland

Refining capacity 16,000 B/D

British Petroleum Chemicals, Ltd. (Anglo-Iranian and Distillers) are constructing a plant at Grangemouth.

The Scottish Oils (Anglo-Iranian) refinery is being greatly expanded (from 14,000 bbl a day throughput to 35,000 bbl daily by the end of 1950).

Spain

Refining capacity 14,600 B/D

Compañía de Investigaciones y Exploraciones Petrolíferas, known as C.I.E.P.S.A., has completed a well in Oliana (Lérida), reaching a depth of 2430 meters. Drilling will be shortly started again. A well is being drilled in the province of Soria. The present depth reached is over 1000 meters, and work is going on.

The extension of Cía. Española de Petróleos, S. A. (CEPSA) Tenerife refinery is much advanced. It is hoped it will be running by next November 1949.

The Cartagena refinery, of which Caltex holds 24 per cent and the balance is owned by Spanish interests, is also nearly finished. It is believed it will be ready to operate in November, 1949. Capacity will be 5000 bbl to start and later will be increased to 20,000 bbl a day.

A Socony-Vacuum affiliate has had one rig in operation in north-central Spain at Burgo de Osma since December 1948.

Sumatra

Prod. 85,000 B/D **Ref. Cap. 105,000 B/D**

The long awaited peace between The Netherlands and Indonesia seems closer. When this happens Sumatra is due rapid development of its resources, beginning with rehabilitation of fields not worked on since the war.

Standard Vacuum Petroleum Maatschappij, of which Jersey Standard owns 50 per cent, has expanded its refinery operations at Palembang, Sumatra, to 55,000 bbl per day.

Syria

Syria Petroleum Company, Ltd. Two exploration wells were completed and abandoned and two were in progress at the end of the period.

Trinidad

Prod. 55,000 B/D **Ref. Cap. 91,000 B/D**

Little change in the conditions governing the tempo of the industry occurred during 1948. The exploratory drilling program is progressing although allocations of steel and dollars are limiting factors. No marine licences have yet been granted.

During 1948, 22 drilling rigs were in continuous operation. Total footage drilled was 638,681 as compared with the 1947 figure of 644,689. The average depth of wells completed during the year was 4259 ft. The previous drilling depth record for the Colony of 11,042 ft has been broken during 1949, when a depth of over 12,000 ft was attained.

Total production of crude for 1948 at 20,110,901 bbl declined by 2 per cent in comparison with the 1947 figure; this represented an average daily production of 27.3 bbl per producing well.

On the refining side, crude run to stills during 1948 amounted to 27,074,000 bbl, an increase of 7.1 per cent on the 1947 figure, due entirely to the bigger volume of foreign crude imported.

In 1948 petroleum and its products represented approximately 78 per cent of the Colony's total exports. Direct contributions by the industry to the Colony's revenue approximated to 26 per cent of the total receipts.

Labor conditions remained satisfactory.

Turkey

Prod. 200 B/D **Ref. Cap. 200 B/D**

Maden Tetkik ve Arama Enstitusu (Metea) is the government organization in charge of the development of the petroleum resources in this country. Several wells had been drilled by this organization prior to 1948 but no production had been found. During 1948 the very important Ramandag oil field was brought into production and several wells have been completed.

With the rediscovery of oil in Raman in larger quantities than before in well No. 9 last March the development of the field has gone ahead as rapidly as the equipment at hand has permitted. Since that time Nos. 10, 12, and 14 have encountered the pay zone with productions ranging from 350 to 700 bl per day. On account of the limited capacity of the topping plant near the field only one well at a time has been pumped. Well No. 12, which gives the best production, is near the apex of the structure with a cavernous limestone pay section. No. 14 well is being drilled deeper to test the possibilities of the Paleozoic sands. This well is drilling at present at about 2350 meters.

In the region of Adana geophysical activity has gone ahead without interruption. Two locations have been made for which new drilling equipment is being hauled to drilling sites. The superior geographical position of the Gulf of Alexandretta basin, in which Adana is situated, has commanded special interest among foreign oil men.

Since 1948 all drilling operations for the Turkish government have been

*Pet. Assn. of Trinidad.

supervised and directed by Drilling and Exploration Company, Inc. of Dallas, Texas.

Uruguay

Refining capacity 17,000 B/D

A government monopoly controls exploration for oil and the only refinery in the country.

Venezuela

Prod. 1,303,000 B/D Ref. Cap. 192,000 B/D

Sinclair. Venezuelan operating companies of Sinclair Oil Corporation and affiliates hold approximately 1,400,000 acres of petroleum concessions in eastern, central and western Venezuela. Three oil and gas fields have been developed by Sinclair Oil & Refining Company in the state of Monagas in Venezuela, namely Santa Barbara, Muri and Travieso. To date it has drilled a total of 223 wells, of which 18 were dry, 5 were gas and 200 were oil wells. Since August 1943 it has produced from these fields approximately 52,000,000 bbl of crude. At the present time it is drilling one wildcat in Guarico and one in Monagas. Extensive seismograph surveys were made during the past year on the company's undeveloped concessions.

Sinclair and Venezuela Petroleum Company (Sinclair) own 7 per cent overriding royalty on 5207 acres in the Maracaibo area, 2662 acres of which at the present time are producing.

Sinclair Oil and Refining Company operates its own 12-in. pipe line from its pump station at the Santa Barbara field to the sea coast at Puerto de la Cruz, approximately 100 miles, and at Puerto de la Cruz, a deep water terminal.

Under construction at the present time is a modern refinery of 35,000 bbl daily crude oil charging capacity at the Puerto de la Cruz terminal. It is expected that this refinery will be completed in 1950.

Sinclair Oil and Refining Company is the operating subsidiary of Venezuelan Petroleum Company in Venezuela with offices in Caracas.

Atlantic Refining Company. Venezuelan Atlantic Refining Company continued development of properties jointly owned with Pancoastal Oil Company, assignee of Pantepec, located in the States of Anzoategui and Guarico. One producer and one dry hole were drilled in the Pelayo field. One producer and three dry holes were drilled in the Socororo concession, both in Anzoategui. In the Tucupido field, Guarico, 29 producers and 5 dry holes were completed. In addition, a new field was discovered in the Ruiz 3 concession and several successful stepouts were completed.

Pipe line outlet for the Pelayo production was made by construction of a 13-mile, 6-in. pipe line connecting with the Gulf Mene Grande system at Leona. Outlet for the Ruiz area is being planned with construction of a 12-mile, 8-in. pipe line to join the Atlantic's present system in the Saban field.

On wholly owned properties, Venezuelan Atlantic Refining completed 8 oil wells, 3 gas wells, and 6 dry holes on the Saban concession, south of Tucupido, and five producers in the Taman area, east of the Tucupido field, both in Guarico. Various other exploratory holes were drilled in eastern Venezuela, as well as one in the District of Mara, State of Zulia, all with negative results.

As many as 4 geophysical parties have been operated this year but at present this activity is suspended. Six rigs are running and another will be activated during the dry season.

Creole Petroleum Company. The new Creole Petroleum Corporation refinery at Amuay, Venezuela, is expected to go into operation near the end of this year and will have a capacity of 60,000 bbl a day. Contracts were let for construction of 620 houses for refinery workers.

In December 1948 the first oil flowed through Creole's 24 and 26-in. crude line from Lake Maracaibo 145 miles to Amuay Bay, Venezuela. It is the largest diameter crude line in service and is handling between 250,000 and 325,000 bbl per day. It is estimated that this line replaces the services of 25 shallow-draft crude tankers at a substantial transportation savings.

Phillips Oil Company, a wholly-owned subsidiary of Phillips Petroleum Company, continued drilling at the Mata Grande area in Venezuela during the latter part of 1948. During 1949 only work-over operations have been carried on in the field.

In January, 1949, a wildcat well, discovery of the San Roque field, was completed in the state of Anzoategui with prolific production in four zones. On production tests the top zone flowed 40 deg gravity oil at the rate of 1500 bbl a day on 3/8-in. choke. The three sucessively lower zones produced on test at the rates of approximately 500 bbl per day, 300 bbl and 500 bbl, all on small chokes and with gravities ranging from 41 to 45 deg. Phillips now has 6 rigs working in the San Roque field. A company camp is nearing completion in the field.

Phillips has two geological field parties operating in addition to one contract seismograph party in Venezuela.

Socony-Vacuum. In Eastern Venezuela, drilling operations were centered in the Chimire area in the extension of Chimire field, which was discovered in early 1948. Pascua No. 1, a wildcat well in North-Central Guarico was abandoned as a dry hole.

In Western Venezuela two producing wells were completed in the Barinas area.

The Texas Company. In the Mara field in western Venezuela, four wells were completed during the past year. Raban wells 4, 6, and 7, each tested over 6300 bbl per day after acidizing the Cretaceous limestone section, while Raban well 3, was a light producer. Raban 5, a stepout well at the north end of the field was temporarily suspended at a total depth of 7853 ft, and Raban 8, indicated as satisfactory producer, was testing at a depth of 7982 ft. The production of Texas Petroleum Company in this field is currently restricted to a level around 20,000 bbl per day.

In eastern Venezuela, drilling in the Tucupita field was suspended in April after completion of T-46. This field, which produces oil of 16.5 gravity, has been restricted to 5000 bbl per day. It is processed in a topping plant situated on the concession. T-3, a wildcat 2 kilometers north of the field, was abandoned last September at TD 6200 ft. Sotil 2 wildcat, 50 kilometers northwest of Tucupita, was coring at a depth of 10,278 ft at end of July. No further drilling was done in the Rincon Largo area, which is currently producing about 1800 bbl per day of light crude.

Wales

Refining capacity 20,000 B/D

National Oil Refineries, Ltd. is constructing a crude distillation unit to enlarge capacity to 62,000 bbl a day.

U. S. S. R.

Prod. 600,000 B/D Ref. Cap. 550,000 B/D*

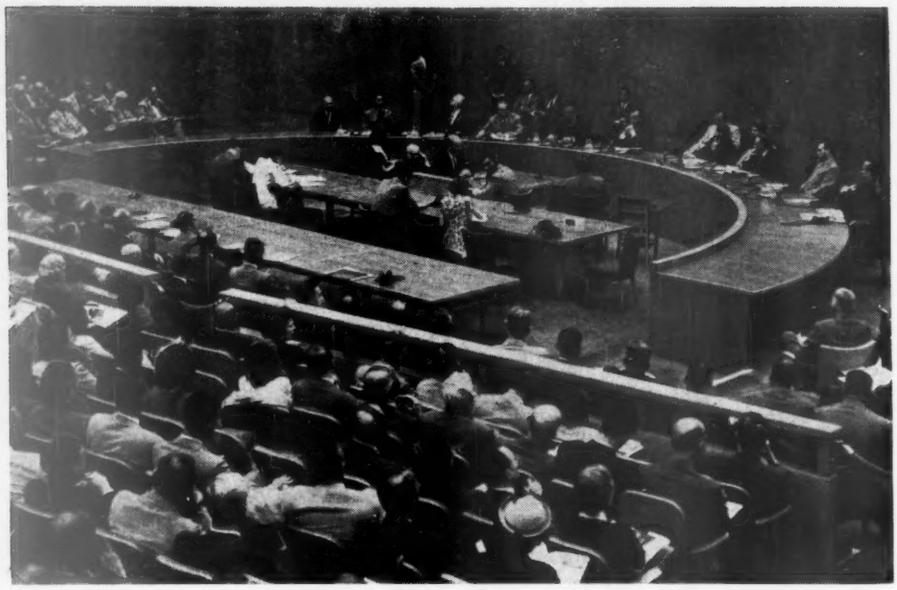
The Soviet's habit of dealing with percentages leaves even direct government reports a matter of speculation. Production from the former East Poland is part of the Russian output. Even so, this estimate may be generous in view of the growing effects of depletion in old fields.

Yugoslavia

Prod. 1000 B/D Ref. Cap. 8100 B/D

Yugoslavia will be able to get the oil imports and oil equipment it needs from the west now that trading is expanding between the Communist step-child and the western democracies. The 1947-1951 Five Year plan calls for 9250 bbl a day in 1951. Present production is probably little more than 1000 bbl daily. * * *

*An average of several estimates.



Opening meeting of United Nations Scientific Conference on Conservation and Utilization of Resources held at Lake Success, New York, August, 1949.

U N Resources Conference

L. C. UREN*

In 1947, President Truman suggested that the United Nations organization should sponsor a conference that might be attended by representatives of all the member nations, to discuss means of conserving and more efficiently utilizing the world's remaining natural resources. The proposal is said to have been prompted by the then current world-wide post-war scarcity of foods, fuels, strategic minerals, and other products of the earth, and the growing realization of the necessity for better distribution and avoidance of waste in future use of scarce materials. The belief was expressed that a more equitable distribution of the world's resources might be a powerful factor in promoting world peace.

The President's proposal was considered favorably by the United Nations authorities and decision was reached to hold the proposed conference at the Lake Success headquarters under the auspices of the Economic and Security Council. The planning of the conference was entrusted to a committee of the Council in which representatives of U. S. Government agencies concerned with natural resources had an active part. A committee composed of prominent American citizens interested in the several fields of technology and science involved, gave active assistance. Invitations were extended to all member nations to organize and send delegations of qualified scientists. Various scientific societies were asked to nominate representatives. The planning committee proposed the names of other individuals prominent in their respective fields who should be invited to attend. A program of papers was planned and qualified individuals were asked to prepare them. Others were invited to discuss the papers submitted. After nearly two years of careful planning, the conference convened at Lake Success on August 17, 1949, with 450 representatives from 49 different countries in attendance.

Plans for the conference made provision for 31 sessions of approximately 2½ hours each — generally two each working day — distributed over a period of nearly three weeks. A program of plenary sessions designed to provide all delegates with a broad view of all phases of the work of the conference was held, one each afternoon, with additional plenary morning sessions on the first two and final two days. On other mornings, section meetings were held at which those interested in particular resources were afforded an opportunity to present specialized papers and discussion. Simultaneous section meetings were held for six different fields of interest: 1. Fuels and Energy; 2. Minerals; 3. Forests; 4. Land; 5. Water; and 6. Fish and Wildlife. Generally each delegate had a special interest in, or was best qualified to participate in some one of these fields and attended these sessions throughout the program. The Fuels and Energy sessions, which included all the specialized material relating to petroleum, natural gas, and synthetic fuels, were of wide interest and were well attended throughout the conference.

Each session opened with a carefully prepared survey paper designed to "set the stage" for the particular topic to be discussed. This was followed by "experience papers" offering practical data from industry, and these were followed by discussion, often prepared in advance by invited "discussants." Opportunity was freely afforded all delegates who wished to participate in the discussion or ask questions. The formal papers were mimeographed and made available to the delegates in advance of the meeting at which they were presented.

Programs were notable for the orderly manner in which they were conducted and for the mechanics of the means by which all that was said was recorded and made understandable to individuals speaking several different languges. The highly skilled and trained staff of the United Nations Secretariat was largely responsible for this. Each meeting was presided over by a chairman, usually an outstanding authority in the field of the topic to be discussed, who spoke either in English or French, the official languages of the conference. Delegates who wished to participate in the program were seated at a large oval table facing the chairman. Microphones connected with a public address system were placed before each speaker so that he could read his paper or present discussion without leaving his seat. Translators in nearby glass-screened booths, made simultaneous translations of all that was said into English, French, and Spanish. Head phones connecting with the translators' microphones were placed at each delegate's seat, and an electrical selector device enabled each to hear in his own language a full translation of all that was said by any speaker, irrespective of the language used. For dele-

*Professor of Petroleum Engineering, University of California.

EXCLUSIVE

gates and others not seated at the participants' table, small radio receivers with headphones and selector control, afforded the same service. The translators' ability to give finished, "on-the-spot" translations and their command and understanding of the rather specialized terminology employed by the speakers, was considered remarkable. Stenographers before the speakers' table maintained a stenographic record of all that was said, irrespective of the language employed, and the more important addresses were recorded on wax discs for radio transcription. Some of these addresses were broadcast by the United Nations radio station via short-wave, to a world-wide audience.

The opening day's plenary meetings were devoted largely to addresses of welcome and "keynote" address by Secretary General of the United Nations Trygve Lie, New York City's Mayor O'Dwyer, Secretary of the Interior Krug, John Hopkins University President Bronk, and Fairfield Osborn, president of the Conservation Foundation and the New York Zoological Society. Secretary Krug was active in developing plans for the conference and is credited by some with having conceived the original plan which led President Truman to propose it. At the opening session he spoke for the President in officially welcoming the delegates on behalf of the United States Government. In a later address he emphasized the relationships existing between the work of the conference and the now famous "point four" of President Truman's inaugural address of last January, in which he proposed that the United States should share its technical skills and employ its financial wealth in promoting development of resources and improving the standard of living in the less well developed countries of the world. Secretary Krug emphasized that real conservation can advance living standards, remove economic pressures and fears of scarcity, which have been instrumental in promoting war. He stressed, however, that those who use risk capital provided by others must understand their responsibility to the lenders, and that those who lend must understand that no great economic program can justify high interest rates and excessive profits. Low cost credit is essential in all large-scale conservation work.

The Fuels and Energy Section program provided for ten section meetings and one plenary session, concerned with the following topics:

Plenary session: Using and Conserving Fuels and Energy Resources.

Section meetings:

1. New techniques for increasing coal production.
2. Underground gasification of coal.
3. Coal carbonization.
4. New techniques in coal preparation.
5. Techniques of oil and gas discovery and field development.
6. New techniques for increasing production of oil, gas and shale oil.
7. Oil chemistry and refining; synthetic fuel production.
8. Utilization of energy; integrated power systems.
9. Utilization of energy; future outlook for fuel utilization, electric energy and wind power.
10. Utilization and conservation of fuel in space heating.

Space permits of only a brief report on some of the highlights of this program. It is assumed that readers of *The Petroleum Engineer* will be interested primarily in parts of the program that relate to petroleum, natural gas, shale oil, and synthetic fuels, and other parts of the program will therefore be dismissed without further mention.

Exploration. The plenary session featured a paper by I. V. Levorsen, Dean of the School of Mineral Sciences, Stanford University, and former president of the American Association of Petroleum Geologists. In this paper, Dean Levorsen offered an appraisal of the world's undiscovered petroleum reserves. His optomistic estimate provoked discussion from many of the more conservative engineers and geologists in attendance, occasioned a special session on a later day for further discussion, and reached the front pages and editorial columns of the New York newspapers. Levorsen based his estimates largely on previously published reserve estimates of L. G. Weeks, J. E. Pogue, and others in which, by analogy, the volume of sedimentary formations that have yielded our present known oil and gas supplies are compared with the volume of sediments yet to be tested. Reviewing the prospective areas in sedimentary basins throughout the world, the conclusion was reached that the undiscovered reserve is of the order of 1,500,000 million barrels, or 500 times the current annual production. Discussion brought fair agreement that the world reserve in present known fields is approximately 80,000 million barrels, but wide divergence of opinion was disclosed on the probable magnitude of the undiscovered reserve and the method suggested for measuring it. Obviously, the matter is entirely speculative and no truly scientific basis for such an estimate is possible. Though it was conceded by many that the undiscovered reserve might be as large as represented, the propriety of calling it a "reserve" is questionable, for there is no assurance that any very large part of it will ever be found, or that it can economically be produced at a cost below that at which substitute liquid fuels will compete. In his paper, Levorsen concludes that the problem of the adequacy of the world's future oil supply is not determined by the magnitude of the undiscovered reserves, but rather by our ability to find them.

A section meeting afforded opportunity for presentation of papers dealing with recent advances in exploration techniques. A paper by G. M. Lees, chief geologist of the Anglo-Iranian Oil Company, reviewed the various techniques employed in exploration for oil and gas. Lees believes that the needs of succeeding generations will surely be met from the world's abundant resources, but discovery will inevitably become increasingly more difficult. There are few regions in the world in favorable geographical setting that have not been geologically explored in varying degree. Although there is little prospect of new discoveries of the magnitude of those of the Midlde East, yet there is every chance of discovery of new reserves in a wide spread of prospects elsewhere, not individually of major size, but in the aggregate of great importance. The discovery tools of the future are not likely to differ greatly from those of the present day, namely, intensive geological study and speculative geological thinking, aided by intensive geophysical application.

M. L. Migaux, director general of the French Compagnie Gènèrale de Gèophysique, briefly reviewed the several geophysical methods employed in petroleum exploration and stressed the importance of proper coordination of the techniques of geology, geophysics, and exploration drilling in achieving a high percentage of successful tests and reduction in the cost of finding new reserves.

J. R. Balsley, Jr., of the U. S. Geological Survey, reviewed "Techniques and Results of Aeromagnetic Surveying." In this paper, the advantages of the airborne magnetometer in making rapid, low-cost reconnaissance surveys of prospective areas were stressed, and the procedures followed in making such surveys were briefly described.

Development. A paper contributed by M. H. Parks of the Humble Oil and Refining Company, reviewed the special problems encountered in drill-

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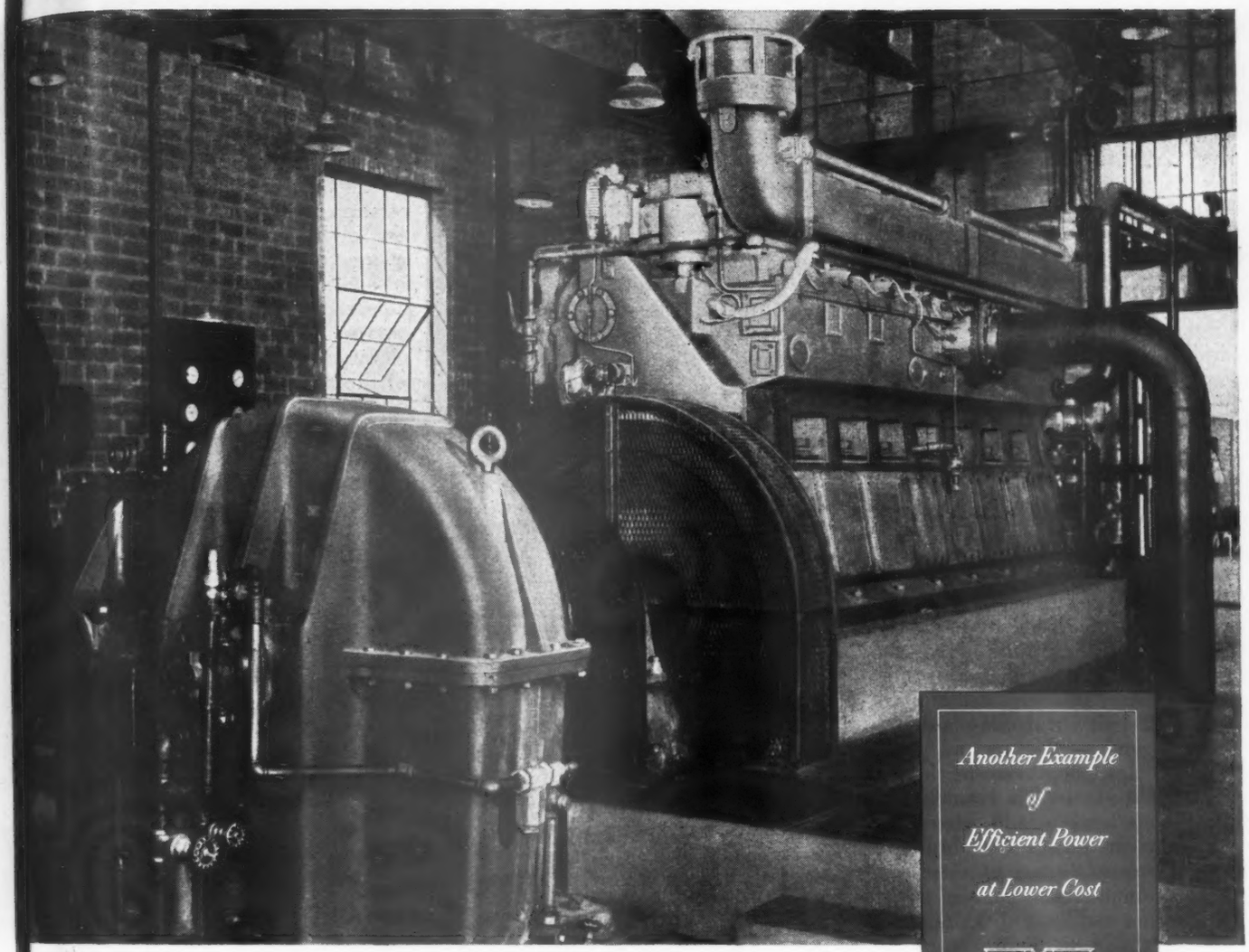
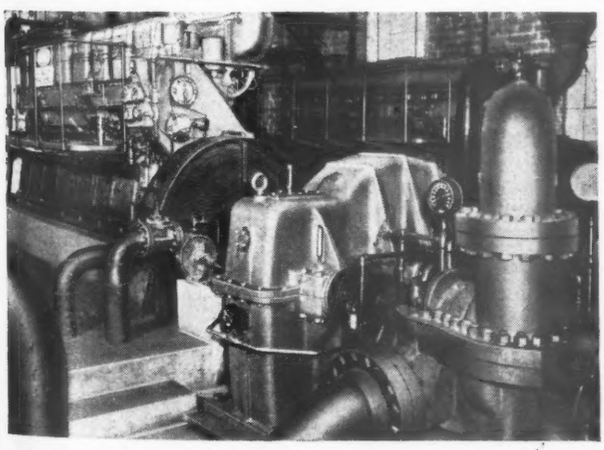
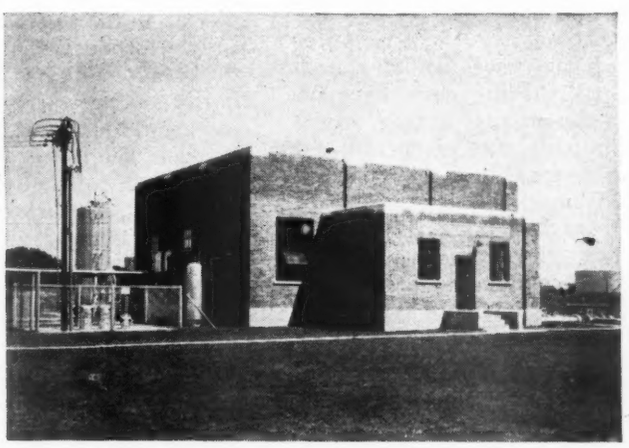


One of the two 690 hp Cooper-Bessemer gas-diesels driving centrifugal pumps in Empire Pipe Line Company's Sour Lake, Texas, station. Typical Cooper-Bessemers, these engines are giving exceptionally economical, trouble-free service.



Shown here from the operating side, these two Cooper-Bessemer engines were originally installed as full oil-burning diesels and later converted to gas-diesel operation.



A view of Empire Pipe Line Company's modern pumping station at Sour Lake, Texas, powered by the two Cooper-Bessemer 690 hp gas-diesels

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ing for oil in off-shore areas of the Gulf of Mexico. In an introductory paragraph, Parks suggests that the 11,800,000 square miles of continental shelf areas of the world may ultimately yield in excess of half a trillion barrels of oil. The continental shelf is defined as a land mass submerged in less than 600 ft of water, but present day exploration methods are incapable of drilling in water depths exceeding 100 ft. Costs are substantially greater than for comparable land development and economic considerations will determine the extent to which these underwater pools may be exploited. The physical conditions encountered in off-shore drilling and producing operations along the shores of Texas and Louisiana and in the Mississippi delta region are briefly described.

I. S. Salnikov of the Standard Oil Company of New Jersey, presented a paper reviewing recent improvements in the equipment and techniques employed in rotary drilling, with particular emphasis on deep drilling. Increased efficiency in drilling is due to such things as unitization and portability of rigs, improvement in the quality of steels used in manufacture of drill pipe, casing and wire lines, more efficient power development through increasing use of diesel engines, and improved systems of power transmission and control. More rapid drilling is due to improvement in drilling muds and drilling bit design, higher rotational speeds and circulation pressures. More dependable logging and sampling devices and improved methods and materials for water exclusion have facilitated well completions. Drilling costs have increased substantially during recent years. The daily cost of operating a heavy-duty rotary rig of the type used in deep drilling operations is said to be as high as $2000, and the average cost of deep wells (in excess of 12,000 ft) in 1948 was about $325,000. Foreign operations are more costly and there is seemingly little prospect of much reduction in drilling costs in the near future.

J. Cirigliano of the Venezuelan Ministry of Development, presented a paper reviewing methods of field development in the Venezuelan oil fields. Marked differences are noted in comparing methods employed in the western and eastern districts. Novel features of marine drilling operations along the shore of Lake Maracaibo are described in some detail. Methods of gravel packing and use of oil-base and emulsion drilling fluids in well completions have greatly improved production efficiency. Cementing techniques and methods of making multiple-zone completions employed in the eastern district are described.

Production. The session on conservation in petroleum production featured five papers by well known authorities. W. J. Murray, Jr., Chairman of the Railroad Commission of Texas, prepared the introductory paper that explained the mechanisms operative in drainage of reservoirs and estimated their relative efficiencies. "Dissolved-gas drive" is said to be least efficient as a producing mechanism, recovering only 15 to 30 per cent of the oil initially in place. "Gas-cap drive," properly controlled, is considered to be a more efficient mechanism, recovering 30 to 50 per cent—occasionally as high as 80 per cent of the oil in place. "Water drive" is believed to be the most efficient mechanism, recoveries usually ranging from 60 to 80 per cent of the oil in place. Combinations of these mechanisms are prevalent. Because of the greater efficiency of gas-cap and water drives, they should be employed wherever possible. The rate of production is considered important in avoiding conditions tending to promote the less efficient solution-gas drive, by-passing of gas and erratic gravitational effects. Only rarely may a field produce more than 5 per cent of its recoverable reserves annually without adversely influencing the ultimate recovery. Operations should be so controlled that the gas-oil ratio and water-oil ratio are maintained at low values. When feasible, surplus gas and water should be reinjected in the reservoir. Cooperation between producers and regulation of producing conditions by a public authority are necessary where competitive conditions exist. A compromise between complete conservation and confiscation of individual property rights must be reached in most cases. Gas conservation is discussed briefly. Gas should never be wasted into the air. If not needed for injection, it should be collected, processed for its liquefiable hydrocarbon content, and the remainder delivered to a market whenever economically feasible.

An outstanding paper was that presented by Morris Muskat of the Gulf Research and Development Company, In this paper, variations in the physical characteristics of oil and gas reservoirs are emphasized. Each reservoir is a "unique and individual oil-producing system, having its own inherent potentialities for oil production and susceptibility to control. The manner of development and operation must be tailored to suit the individual 'personality' of the particular reservoir under consideration." Four sources of energy are recognized as being potentially operative in oil reservoirs: (1) The energy of compression of the oil and connate water within the oil reservoir; (2) the energy of compression and solution of the gas dissolved in the oil and water within the producing stratum or in free gas zones overlying the oil-bearing formation; (3) the energy of compression of the water in bounding and intercommunicating aquifers; and (4) the gravitational energy associated with the relative elevation of the oil in the upper levels of the reservoir as compared to that of the points of exit into the producing wells. Other, probably minor, sources of energy are associated with the inherent compressibility of the reservoir rocks and the interstitial forces developed between the fluids in the reservoir. Recent improvements in oil recovery efficiency due to (1) prevention of waste of reservoir energy, (2) supplementing the natural reservoir energies, and (3) control of the producing mechanisms, are discussed in some detail. In conclusion, Muskat presents estimates of percentage recoveries achieved by different methods of reservoir control, based in part, upon statistics recently published by R. C. Craze and S. E. Buckley. Gas drive is considered capable of producing about 30 per cent of the inital oil content of the reservoir, water drive and gravity drainage, about 50 per cent. As a result of better understanding and improved techniques of production control, it is believed that during the last ten years, the average recovery has increased from 35 to 45 per cent.

A paper by D. Comins of the Anglo-Iranian Oil Company, entitled "Conservation in Production," reviewed the methods adopted for maintaining a high degree of production efficiency in the prolific fractured limestone fields of Iran. The famous Haft-Kel field, with only 43 wells has produced more than 800,000,000 bbl of oil during the last 20 years, and over 75,000,000 bbl were produced in 1948 from 20 wells. Wells are spaced from 1 to 2 miles apart. Reserves are estimated for different areas and about 5 per cent of the available reserve is produced each year. Production is allocated to different sections of the field with the purpose of maintaining a level oil-water interface and assuring uniform advance of edge-water. Production is maintained at such a rate that the gas-oil ratio of produced fluids does not exceed the dissolved gas content of the reservoir oil. No water is produced with the oil. Multi-stage gas separation (usually 7 stages) maintains light fractions in the crude shipped to the

refinery. In the Masjid-i-Sulaiman field, surplus gas and heavy residuum oil shipped back from the refinery, are reinjected into wells penetrating the gas-cap area. Over 100,000,000 bbl of residue oil have been thus returned to the reservoir during the past 20 years, and now constitutes about one-third of the field's remaining underground reserve. Unit operation has been a necessary condition in exploitation by the methods described.

Medina-Olivieri of the Venezuelan Ministry of Development, presented a paper entitled "New Techniques for Increasing Production of Oil and Gas in Venezuela: Conservation in Production." The Government of Venezuela has recently taken measures to control the production methods employed by oil-field operators, with the purpose of assuring a high degree of recovery efficiency. Engineers employed in the Conservation Department of the Ministerio de Fomento are making detailed reservoir studies of the producing fields and, on the basis of facts so assembled, are authorized to prescribe operating procedures. In the Mara and La Paz fields for example, production with a gas-oil ratio in excess of 700 cu ft per barrel is prohibited. A maximum rate of production of 6000 bbl per well per day has been adopted for Mara field and 12,000 for La Paz. It is believed that production rates in excess of these amounts will result in reduced ultimate recovery. It has been shown that reinjection of surplus gas will increase the percentage recovery by 40 per cent and gas is now being recycled in several fields.

A paper prepared by P. D. Torrey, reviewed the history of development of methods of secondary recovery of petroleum in the United States, and offered an appraisal of the results thus far obtained and that may be expected in the future. The U. S. oil reserves producible by secondary recovery methods in present known fields are estimated to aggregate more than 7 billion barrels. The vacuum, gas-injection, water-flooding, and mining methods of secondary recovery are briefly described. Physical conditions that determine whether secondary recovery methods may profitably be employed, are discussed. Recoveries and operating costs by water-flooding are estimated for some of the Appalachian and Mid-Continent fields.

Petroleum Chemistry and Refining. Gustav Egloff of the Universal Oil Products Company "set the stage" for the oil chemistry and refining session with his interesting paper entitled, "Review of Present Status and Trends of Oil Chemistry." He emphasized the growing importance of the chemical industries based on petroleum and natural gas as raw materials. Over 5000 commercial products are now derived from petroleum. New methods of refining enable the industry to satisfy ever increasing demands and to adjust operations to changing markets. Superior automotive and aviation engine fuels and "tailor-made" lubricants have greatly improved motor performance. Gasoline production in 1948 was 922,000,000 bbl, of which more than 60 per cent was produced by cracking. During 36 years that cracking processes have been in use, they have made unnecessary the production of 30 billion barrels of petroleum. Production of liquefied petroleum gas is one of the most rapidly growing industries in the U. S. Recent production has been at the rate of 2 billion gallons per year. Lubricating oils are a $2 billion-a-year business. Many chemicals, such as naphthenic acids, cresols, nitrogen and sulphur products, carbon dioxide, helium, etc., are extracted directly from oil and natural gas. Many derivatives are produced by oxidizing, halogenating, sulphonating, or nitrating petroleum hydrocarbons. Alcohols, formic and acetic acids, aldehydes, and ketones are now produced from petroleum on a high tonnage basis. Further treatment produces plastics and resins, glycerin, acetone, formaldehyde, insecticides, weed killers, fertilizers, fumigants, ammonia, synthetic rubber, detergents, and numerous other chemical reagents of growing commercial importance. Many of these products have resulted from oil industry sponsored research. About $112,000,000, which is 25 per cent of all industrial research expenditures, is spent by the oil industry every year in the United States.

F. Mackley of the Shell Refinery and Marketing Company, Ltd., discussed "Petroleum Refining in the United Kingdom." War-time activity in development of facilities for hydrogenation and production of aviation gasoline are discussed in some detail. Since the war, there has been considerable expansion in refining facilities. It is expected that by 1953, refineries in the United Kingdom will have a capacity of 20,000,000 tons per year and will then be self-sufficient. Pre-war capacity was only 4.5 million tons. Production of various industrial chemicals from petroleum is receiving much attention.

Another paper discussing British experience was that by R. Holroyd of the Imperial Chemical Industries, Ltd., entitled "The Flexibility of the High-Pressure Hydrogenation Process for Liquid Fuel Production." This paper presents results of hydrogenation of coal, tars, and petroleum oils, primarily in the production of synthetic fuels. It is possible to control the hydrogenation process to produce maximum amounts of a desired end product with a minimum of by-products. Thus, hydrogenation of coal can yield fuel oil as its main product or, by other adjustments, a high-volatile motor fuel may be the only product. Control of the temperature and pressure at which the process is conducted and the type of catalyst used will determine the nature of the end product. Ability to recycle unconverted material is an important feature.

Léon Jacque, president and director general of the French Petroleum Institute, presented a paper reviewing the present position and trend of oil chemistry in France. Efforts are being directed toward substantial production of ethylene for manufacture of ethanol, glycol, and ethylene oxide used in manufacture of various solvents, plastics, and insecticides; propylene for production of acetone, acetic products, glycols and glycerine; and butylenes and butadiene for manufacture of solvents, plastics, and elastomers. Detergents are being produced from higher olefines. As yet, the chemical industries require only 2 per cent of the gross volume of petroleum refined in France.

Professor J. W. H. Uytenbogaart of the Technical University of Delft, reviewed the development of the petroleum chemical industry in the Netherlands. Techniques employed in production of sodium alkyl sulphates, polyvinyl chloride, and sulphur from petroleum are briefly described. Alkyl sulphates are used in production of detergents, which have, to a considerable extent, replaced soaps that require scarce fats in their manufacture. Polyvinyl chloride has found many applications, particularly in the clothing industry, in manufacture of cable insulation, floor coverings, etc.

Shale Oil and Synthetic Fuels. The introductory paper on "Synthetic Fuel Production" was prepared by W. C. Schroeder, chief of the Office of Synthetic Liquid Fuels, U. S. Bureau of Mines. The rapidly increasing demand for oil products and the increasing cost of finding, developing, and producing new petroleum reserves, is focusing attention on the possible sources of substitute oil products. Coal, oil shale, and natural gas are the possible sources and the U. S. has a large supply of each. Much of the natural gas is allocated to other use, however, hence coal and oil shale are of particular interest. Coal reserves

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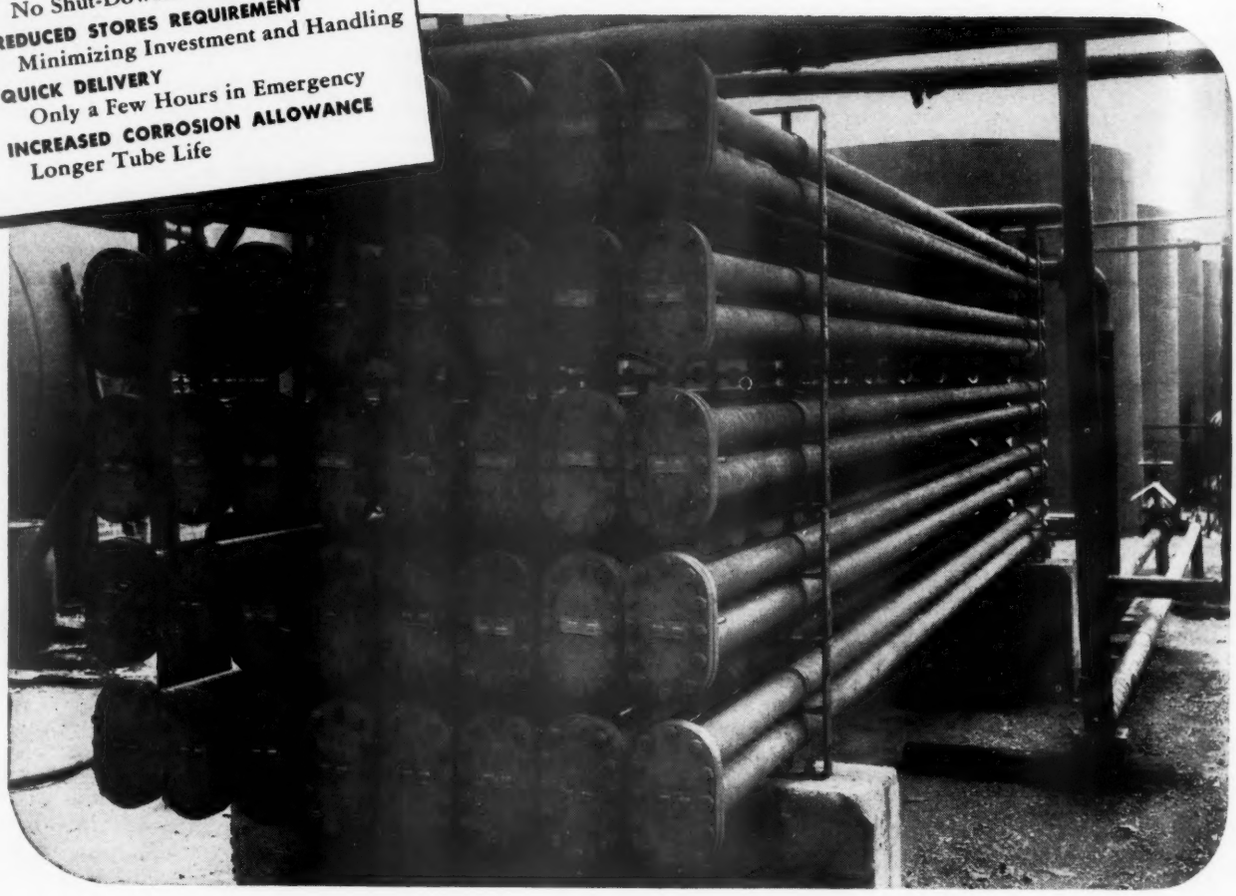

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are estimated at 3 trillion tons: enough to supply U. S. potential oil needs for hundreds of years. Shale reserves in Colorado, Utah, and Wyoming are estimated to contain more than 200 billion barrels of recoverable oil. Oil may be produced from coal either by hydrogenation or by Fischer-Tropsch synthesis of carbon monoxide and hydrogen derived from coal. Oil from shale is produced by simple retorting. Mining operations are involved in either case and constitute one of the principal cost items. The U. S. Bureau of Mines is presently operating demonstration plants utilizing each of these source materials and methods and seeking to develop suitable refining methods for the products derived. Schroeder presents estimates of cost of producing petroleum substitutes by these methods. The cost of producing oil products from oil shale is estimated at only 5.5 cents per gal. Products derived from natural gas by the Fischer-Tropsch synthesis process are estimated to cost 7.2 cents per gallon; from coal, 12.1 cents per gallon. Oil products from coal by hydrogenation are estimated to cost 12.6 cents per gallon. These figures are based on a hypothetical industry capable of producing 2,000,000 bbl per day of synthetic fuel products. Such an industry would require a capital investment (1948 conditions) of about 12 billion dollars, including 10,000,000 tons of steel, and an operating force of 200,000 men. Capital investment per barrel-day of capacity is estimated at $3100 for shale oil, $5300 for synthetic oil from gas, $8600 for synthetic oil from coal by gas synthesis, and $9000 for production by coal hydrogenation. A recent estimate of the capital investment necessary to find, develop, produce, transport, and refine crude petroleum, is $5000 to $6000 per barrel of daily capacity.

Additional information on the Bureau of Mines oil shale operations in the Colorado Naval Reserve was presented in a paper by R. A. Cattell of the U. S. Bureau of Mines. In the Bureau's oil-shale mining operations near Rifle, Colorado, a method of mining has been devised by means of which shale may be mined underground and conveyed to a retorting plant at a cost of about 58 cents per ton. Plant scale retorting and refining operations are also being conducted at Rifle, and laboratory and small pilot plant studies of oil shale and shale oil are in progress at the Bureau's experiment station at Laramie, Wyoming. Several different shale retorts are being tested. Shale oil can be used as heavy fuel oil with relatively simple refining, but production of high quality motor fuels requires preliminary hydrogenation of the crude shale oil. Bureau of Mines estimates indicate that $2.40 per barrel would cover the cost of mining, crushing, retorting, and provision of all necessary utilities except employee housing, in the Rifle area from shale averaging 30 gal per ton with N-T-U retorts on a scale of 100,000 bbl per day. This includes depreciation at the rate of 6⅔ per cent per year, but does not include any profit on the investment. Continuous retorts, now under development, should operate at considerably lower cost.

A. A. Bastos, geologist on the staff of the Brazilian Department of Mineral Production, presented a paper describing the occurrences of oil shale in various parts of Brazil. This country has little coal or oil and development of the oil shale resources is a matter of immediate interest. Deposits in the Paraíba Valley of São Paulo and in Paraná, Santa Catarina, and Rio Grande do Sul appear to offer commercial possibilities.

The shale oil industry of Sweden was reviewed in a paper by E. Schjanberg, professor, research director of the Swedish Shale Oil Company, Ltd. Though studies of the shale resources

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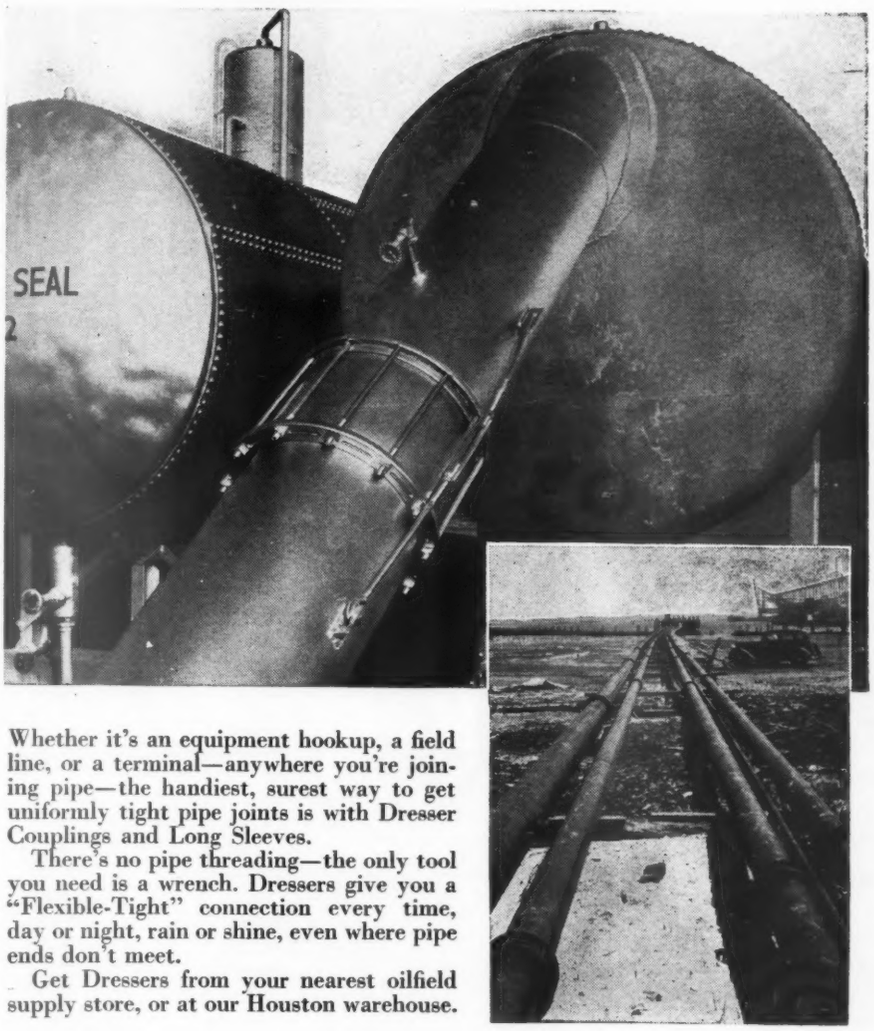

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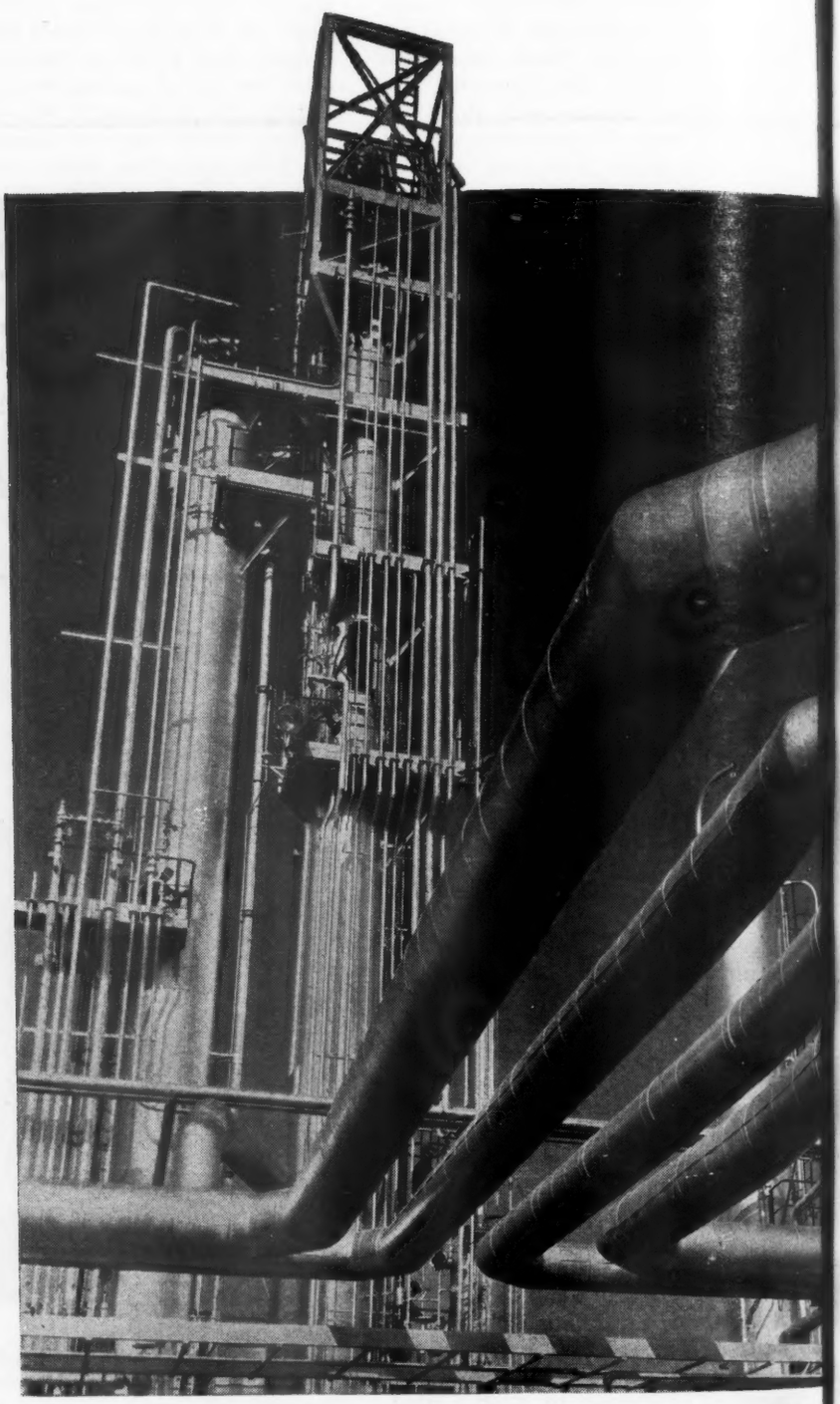

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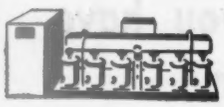
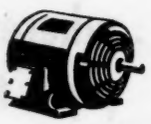
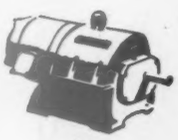


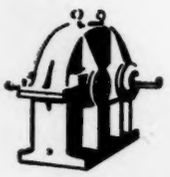
Ignitron Rectifiers



A. C. Motors



Gear Motors



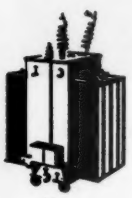
Speed Reducers

Corrosion Resisting Motor Control

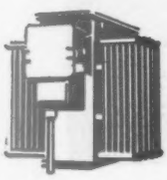
Circuit Breakers for Hazardous Locations

Disconnecting Switches

Instruments



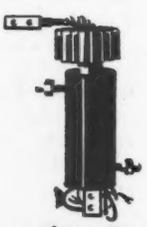
Power Transformers



Distribution Transformers and Switchgear

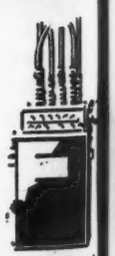
Capacitors

Industrial Lighting



Electronic Tubes

Oil Immersed Pushbuttons



Oil Immersed Panelboards

WESTINGHOUSE

Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY

Unit Responsibility

CUTS REFINERY POWER COSTS

The manufacturer of your power generating and distribution equipment can play a vital role in providing the most efficient power system for your refining and petrochemical processes. In serving you, that manufacturer should be capable of:

1. Providing the complete line of power equipment your process may require.
2. Furnishing you co-ordinated engineering and supervision of installation.
3. Giving you the benefit of years of experience in the application of power equipment in the Petroleum Industry.

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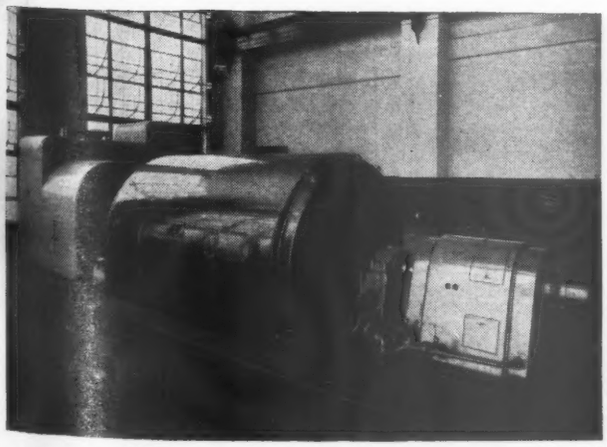
J-94803



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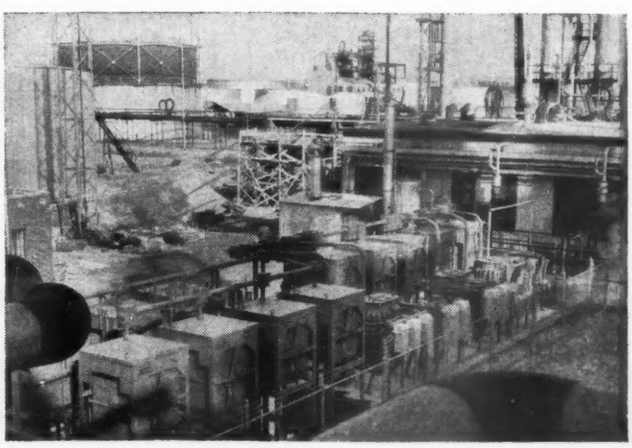

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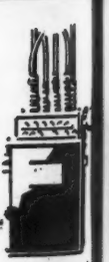
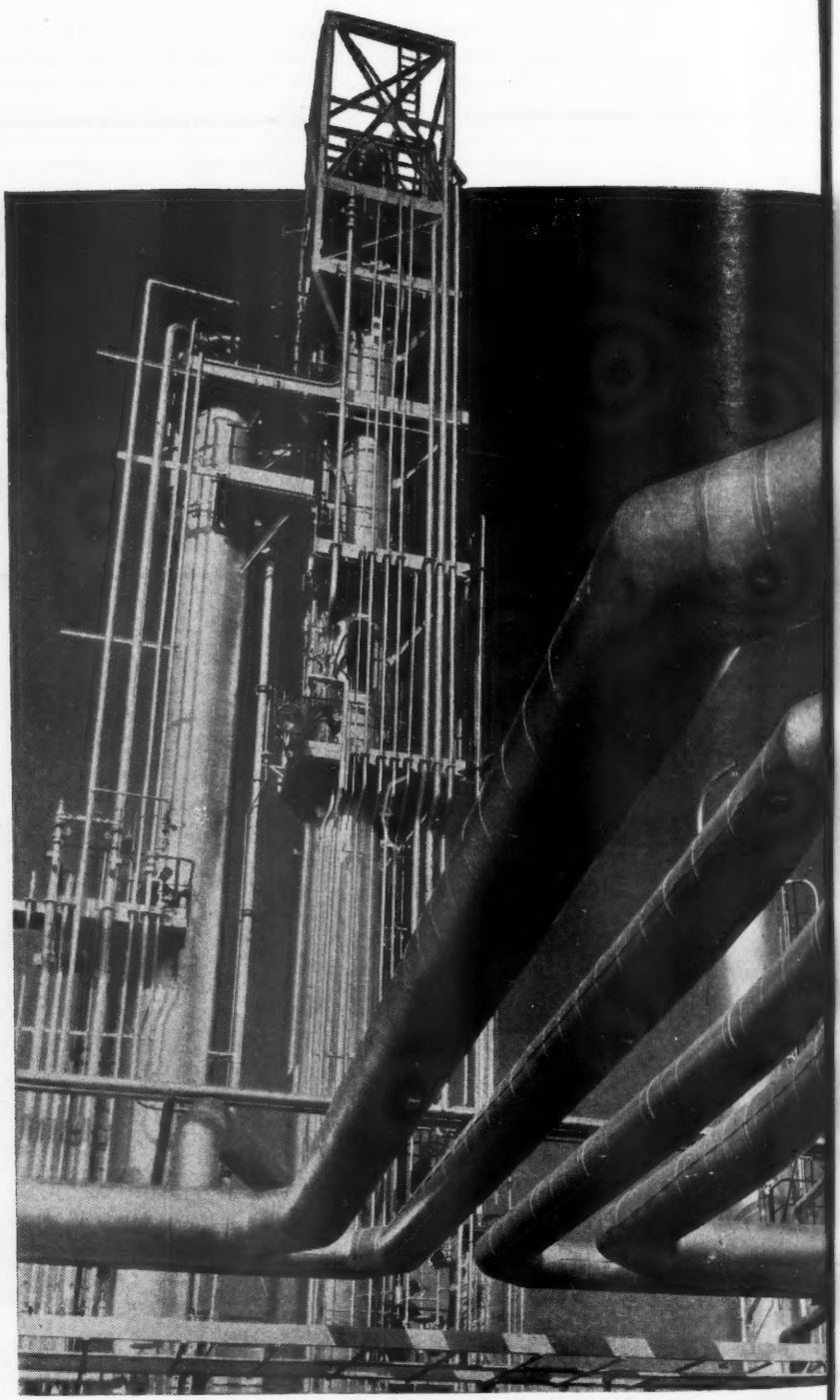


Oil Immersed Panelboards

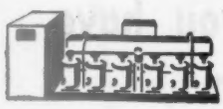
YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Turbines

Turbo Generators



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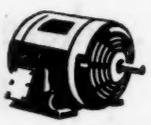

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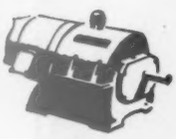

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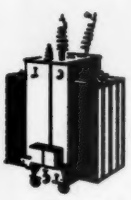
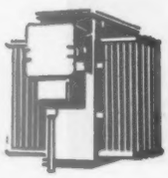


Power Transformers



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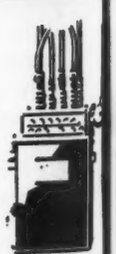

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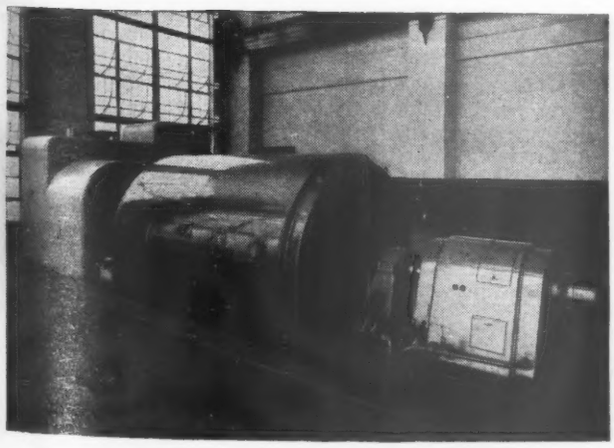

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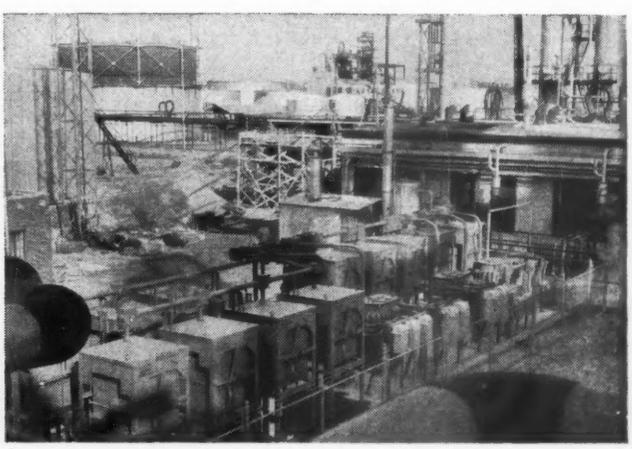

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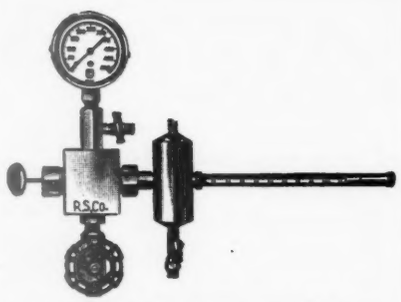
of Sweden were conducted for many previous years, it was not until 1939 that efforts were directed toward development of a shale oil industry of commercial proportions. At Kvarntorp, where the shale is mined by surface methods, four different methods of retorting are being used, two of which now have a combined capacity of 3000 tons of shale per day. A unique method involving distillation of the shale *in situ* by electricity is being tested. Development of by-products is essential to commercial success. Potash, clay, and uranium present in the spent shale after retorting, may have commercial value. The ash may also be used in production of light concrete aggregate, bricks, and cement. Gas and coke for industrial use are also of commercial importance. Research is being actively pressed to solve the many technical problems that surround this industry. Oil is produced at a cost that permits it to compete with imported petroleum, and prospects seem favorable for expansion of this industry.

A paper by S. Landa, professor, Czech Institute of Higher Learning, Prague, reviews results of synthetic fuel production in Europe, with particular reference to the methods developed in Germany and other central European countries by hydrogenation and the Fischer-Tropsch process as applied to coal. Factors influencing the economic operation of synthetic fuel plants are discussed and capital requirements and operating costs are estimated. Prospects for further development of the industry in this region are considered excellent.

One might continue with discussion of many other papers presented at the conference that should be of interest to petroleum technologists. For example, there were excellent papers on underground gasification of coal and an entire session on corrosion of metals. Available space, however, does not permit a more extended review.

In closing, it would appear to be appropriate to consider briefly the results of the conference and the benefits that might derive from meetings of this character. Perhaps the most important result achieved was a general feeling of mutual respect and good will among the representatives of the many nations present. Here was an open forum, free of political influences, providing for unrestricted exchange of ideas, results of research and disclosure of methods that have been found helpful in promoting industrial efficiency and the standard of living. A truly world-wide point of view on conservation and utilization of resources was fostered. At no time were nationalistic ambitions or restrictions on free flow of resources between the nations allowed to find expression. It is unfortunate that Russia and her satellite countries chose not to participate. Such a conference was a desirable preliminary to whatever efforts may later be made by the United States Government in promoting investment of American capital and sharing of technical skills with other countries as proposed by President Truman and urged by the U. S. State Department. The regions in which such investments are needed have been more fully disclosed. Representatives of the countries concerned are returning to their homes with a better appreciation of what is involved in such extension of American influence and with a friendlier and less suspicious feeling concerning our intentions. Many fine technical papers were prepared and presented by outstanding authorities in their respective fields. These will presently be printed and incorporated in volumes of well digested technical information available to all who may be interested. Many of those who attended the conference believe that it might well be the first of a series of similar conferences to be held in future years under United Nations auspices. * * *

ACCURATE TESTING EQUIPMENT FOR FIELD AND PLANT

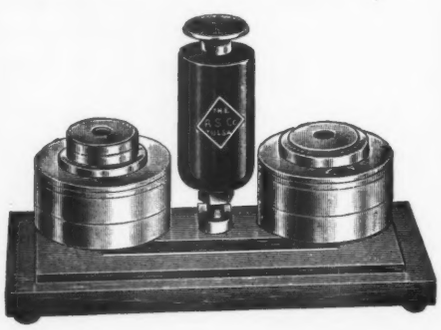


DEW POINT TESTER

Simple to operate. Dew points can be determined with an accuracy of 0.2F., even on high pressure gas transmission lines. Standard range is 0 to 500 P.S.I.

R. S. DEAD WEIGHT GAUGE

Can be put on a line at any connection where ordinary gauge is placed. Gives exact pressure in line by actual dead weight.



R. S. PLUMB BOB THERMOMETER

Serves THREE purposes: To carry the tape down; to read temperature of the oil; to measure the water in bottom of the tank. Complete with thermometer, Range—20° to 120° F., 20° to 180° F., and 30° to 220° F.

Write for Catalog 30-B—Complete Line of Scientific Laboratory Equipment

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Ex

THE

Exportation of Talent to Foreign Lands

ASSISTANCE given foreign nations by the men and machines that have developed our domestic petroleum industry represents an export of talent—"know-how"—that augurs well for the improvement of living conditions of the people of foreign countries. The opening of large new foreign oil fields need not threaten the commercial health of our domestic industry—it should improve the health of foreign commerce and the standard of living of foreign peoples. Petroleum is needed by foreign peoples, who will learn, as we did, to appreciate its usefulness and to pay accordingly for its discovery, development, and distribution.

When one considers the important contributions of the petroleum industry to our way of life in the United States, it is little wonder that our high standard of living is the envy of less fortunate people in the rest of the world. Almost everyone has the use of an automobile and the time and money to enjoy it. Millions of families tour the U. S. every year. They are encouraged by a gigantic system of good highways and the fact that gasoline and oil are readily available and reasonably priced in every area of the country. The life of almost everyone is more comfortable as a result of an abundant supply of petroleum and its products. The technological progress in our petroleum industry has paced the progress of our civilization.

The export of U. S. know-how, equipment, and dollars to develop foreign oil fields was begun more than 30 years ago, when "experts" were predicting that the domestic supply would soon be exhausted. Our domestic supply (proved reserve) is now about four times what it was in 1919, and it is capable of meeting five times the demand at that time. This fortunate situation combined with a continuing high rate of new pool discoveries makes it impossible to forecast the time when we will become dependent on foreign supplies of petroleum. It is possible that other cheaper fuels will be developed before that time ever arrives.

Although it is true that our domestic supply has been supplemented to a minor extent over the years by importation of foreign oil, the necessity for imports has never existed, except as the companies who developed the foreign oil supplies needed to recoup their investments and desired to make a profit. The importation of enough foreign oil to hurt the market for domestic oil is unlikely—at least for any considerable length of time, for it would eventually hurt the importing companies who have so much invested in domestic fields and facilities.

We should be proud of our export of talent and equipment to foreign lands—where the discovery and development of great new supplies of petroleum can mean so much in the improvement of the standard of living of foreign peoples. We are helping ourselves by helping others help themselves.

K Marshall Fagin

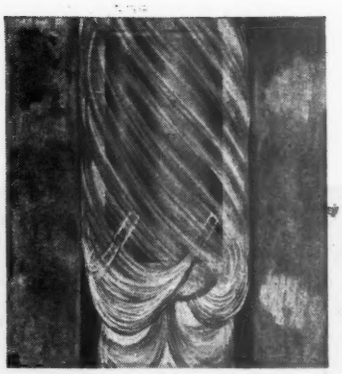
"Whirling on center" is the key to Cementing Success

NO OTHER EQUIPMENT—no other method of cementing—provides such assurance of successful "first-time" cementing as the exclusive Baker Principle of "whirling" the cement up and around casing which is effectively centered in the well with Baker Model "G" Casing Centralizers.

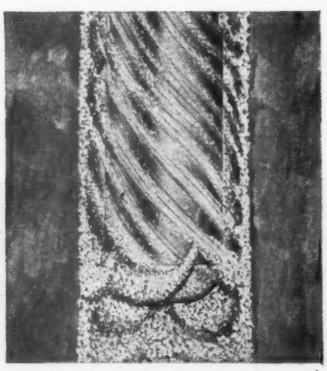
Not only can you REMOVE BRIDGES which might stick the casing; not only can you wash the wall of the hole to help REMOVE MUD CAKE and leave the formation prepared for effective bonding with the cement to follow, but the definite *downward,* then *upward* whirling motion of the cement slurry REDUCES THE HAZARD OF CHANNELING TO A MINIMUM, and assures COMPLETE ENCASEMENT OF THE PIPE at the critical shoe joint with a uniform body of cement.

Study the illustrations below for visual proof of what "whirling" means to you.

The downward hydraulicking action of the circulating fluid through the baffled side down-whirler ports, and the nozzle-like bottom passageway, effectively remove bridges and permits safe running of the casing string.



When washing the formation at the cementing point to condition the hole, the "whirling" motion of the fluid helps remove mud cake from side walls. This *downward* whirling is far superior to any *side* jetting action, and does not cause caving or crumbling of soft formations.



The "whirling" motion given to the cement slurry as it is discharged from a Baker Wash-Down Whirler Shoe causes the cement to encase the centered shoe joint with a uniform body of cement, and reduces to a minimum the hazard of channeling.

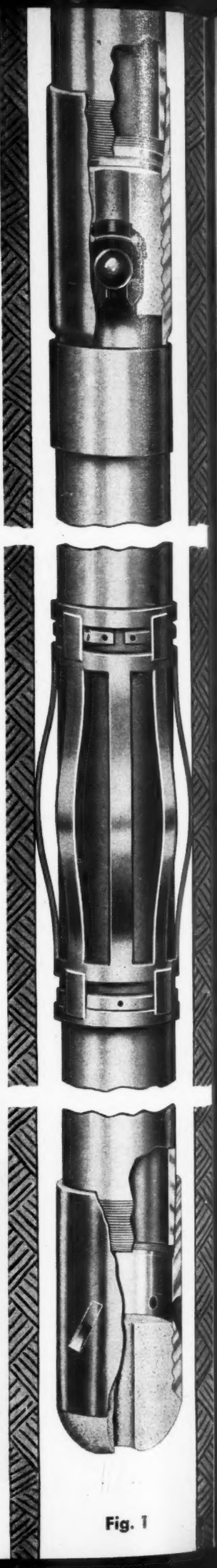
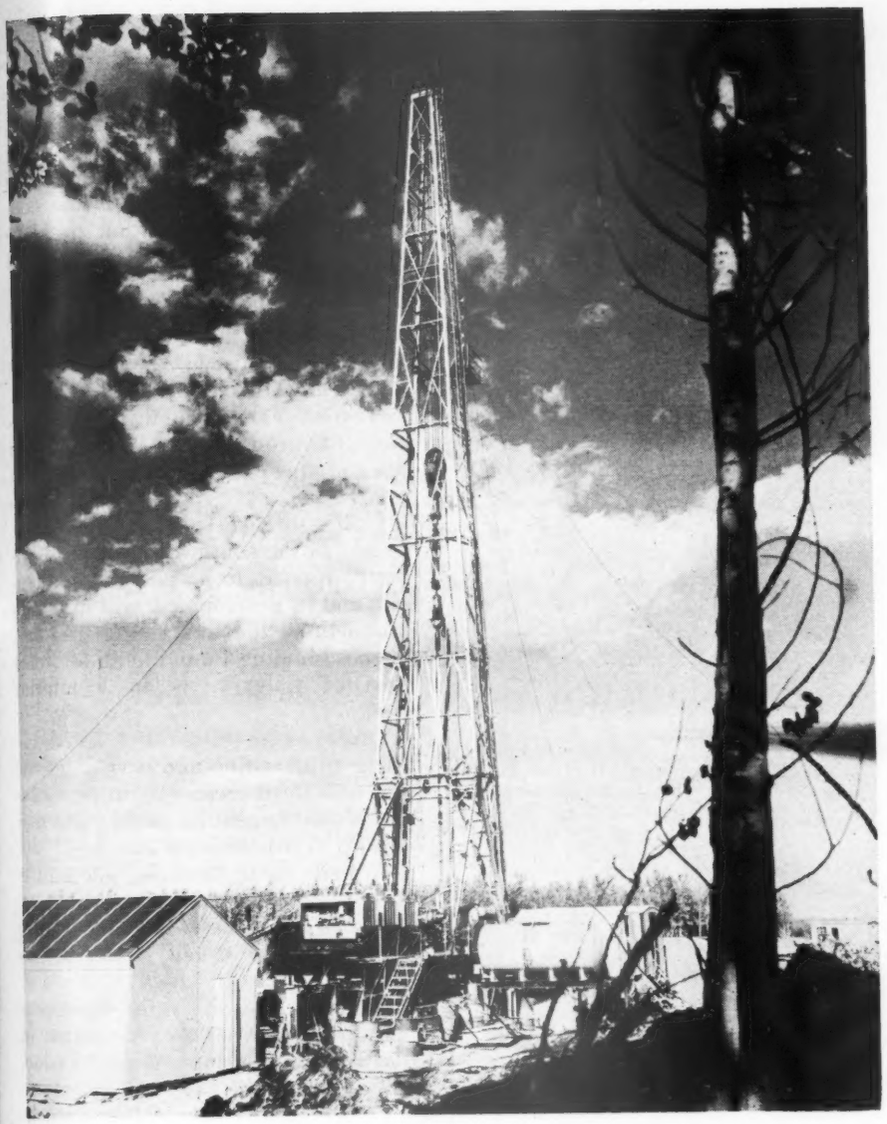


Fig. 1



General Petroleums Ltd. No. 16 at Texaco-McColl Lisburn wildcat about 50 miles northwest of Edmonton. Drilled to 6500 ft in 53 days including the setting of surface casing, some 450 ft cored, and three drillstem tests.

Photo by Bland, courtesy General Petroleum Ltd.

Canada, 1949

FLOYD K. BEACH*

THE discovery of a major oil field at Leduc in 1947 fired the imagination of the industry, not only by its size, accessibility, and good quality of oil, but also by its source. The first discovery in February was in the second Devonian limestone, tentatively called D-2 and probably equivalent to the Jefferson lime, which had first been found as an oil-bearing reservoir at Princess in 1944. The deeper Leduc discovery in May, 1947, proved to be a Devonian reef and was tentatively called D-3. Earlier Devonian reef production had been found at Norman Wells, almost on the Arctic Circle, about 1000 miles from Leduc. The Norman Wells field was developed as a wartime project to supply oil to Alaska through the Canol pipe line. Its development as a peacetime project would not have been economic, but the potentialities of the reef production were worked out, and when Leduc D-3 horizon was shown to be analogous, it became apparent that a source rock had been established in an environment that would not be continuous, but which might be scattered over a tremendous stretch of country.

Woodbend was found in January, 1948. It was also a D-3 reef discovery with a water level almost exactly the same as in Leduc D-3 in the township to the south. This pointed to the probability that the two discoveries were part of the same pool, and subsequent development tends to confirm this supposition.

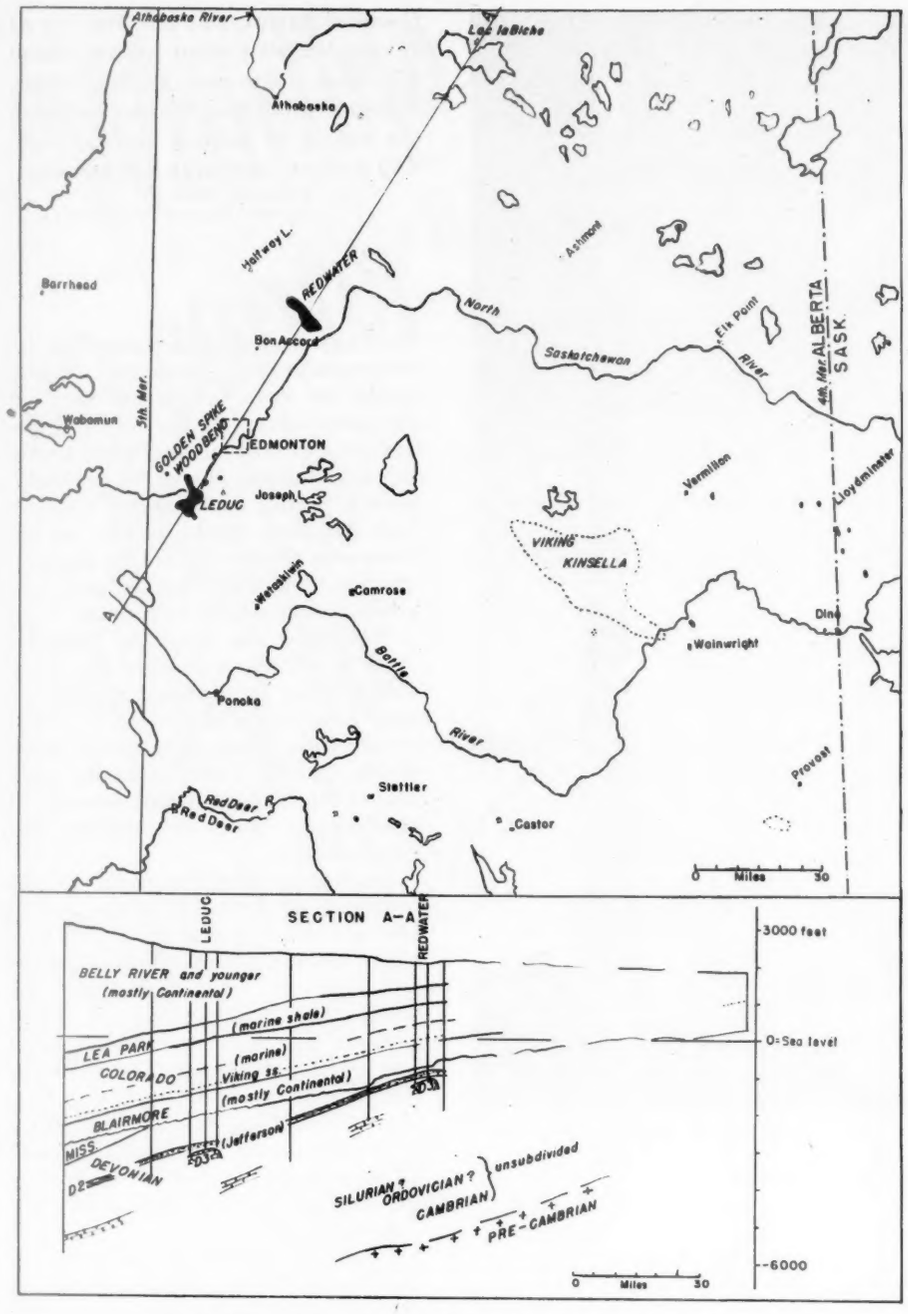
Redwater, some 50 miles to the northeast of Leduc, was discovered late in 1948. It is also a D-3 reef and, where Leduc has about 35 ft of pay in D-2 (perhaps less) and about the same in D-3, Redwater had pay of 140 ft in the discovery well, and its area was about the same as Leduc-Woodbend. Leduc oil is of 39 to 40 deg API, almost free of sulphur, and contains a good lubricating fraction. Redwater oil is of 34 deg API with some hydrogen sulphide content, but still of good refining quality.

Reservoir studies of Leduc-Woodbend suggest total reserves, including also an oil bearing horizon in the Blairmore formation (Lower Cretaceous age) approaching 200 million bbl. Studies of Redwater suggest probable reserves of the order of 300 million bbl. First appearances of Redwater conditions suggested greater porosity and permeability than subsequent evidence supports, but this guess at reserves will probably be supported if the pay yields 150 bbl per acre ft. The oil is very much undersaturated with gas, but pressure records in conjunction with withdrawals suggest that there must be a water drive, so with average porosity possibly as low as 8 per cent, the estimate of 150 bbl per acre ft may not be unreasonably high.

This indicates that oil reserves of the order of 500 million bbl are available in Leduc-Woodbend and Redwater.

*Engineer, Petroleum and Natural Gas Conservation Board of Canada. Mr. Beach has covered Canada for *The Petroleum Engineer* for several years.

EXCLUSIVE



Oil fields are solid black; gas field, dotted lines.

FIG. 1. Most active area in Alberta, 1949.

Golden Spike

Golden Spike is in the township west of Woodbend and in Imperial Schoepp No. 1, oil level started in D-3 reef, a little lower than water level in Woodbend, and continued for 544 ft before reaching a non-porous horizon and another 116 ft before finding water. This is very evidently a separate reef from Leduc-Woodbend. Successive drill stem tests in which the packer was set so as to test only new sections of 20 ft or more showed that all of the 544 ft of reef was good pay. Since this well was completed, a well 3 miles to the northeast, another 3½ miles to the northwest and one 3 miles to the east in Woodbend township were all failures, but there is no means of guessing how much area the pay covers, and consequently of assessing reserves. It looks most interesting in any event, and development drilling for September has been announced.

About 6 miles southwest of Stettler and 85 miles southeast of Leduc, Canadian Gulf completed a well in June, 1949. It had about 50 ft of pay in D-2 with 30 or 32 gravity oil and about the same thickness in D-3 with about 28 gravity oil. There is as yet no indication of the area underlain by pay, but there is room in unprospected surrounding land for a field the size of Leduc.

The area Lloydminster-Vermilion-Wainwright-Dina in Alberta and extending some distance into Saskatchewan contains a number of pools of black oil, but its quality and high viscosity appear to bar it from consideration as a reserve that could be piped for long distances and refined for gasoline.

Princess, Taber and Conrad fields to the south of the map area of Fig. 1 have not established reserves that are significant in comparison with Leduc.

Turner Valley, southwest of Calgary, has produced nearly 100 million bbl and may produce another 30 or 40 million bbl.

Gulf's discovery south of Pincher Creek, in the southwest corner of Alberta, appears to be gas and condensate and its development will hinge on production and marketing of gas. Shell's Jumping Pound field, 30 miles west of Calgary, is in a similar category.

Other recent discoveries listed below are interesting and may point the way to material reserves but they cannot at the moment be said to add materially to Alberta's oil reserves.

Armena, near Camrose, got a little oil in the uppermost Devonian (D-1).

Joseph Lake has oil in the Viking sand, a horizon usually water or gas bearing.

Whitemud has oil in the Blairmore (Lower Cretaceous age) somewhat in line with the Blairmore pool of Leduc, a few miles to the west.

Campbell, just beyond the northwest outskirts of Edmonton, has a small Blairmore discovery.

Bon Accord has D-2 oil but D-3 reef is not present.

Barrhead found some oil and water in the Madison (Mississippian) and produced a little oil during extended tests, but had water in D-2, and D-3 was not present.

Tar Sands

Aside from these and other minor showings, the tar sands, some distance to the north of the map area in Fig. 1, contain fabulously large reserves, but to get them involves stripping overburden, quarrying the sand and separation. When separated the oil would be lower in quality than Lloydminster crude, would require at least a visbreaking operation before it could be piped any great distance, and would be suitable for making gasoline and other light products only after rather costly treatment. Notwithstanding these considerations, the Alberta Government has been doing work with a pilot plant to investigate separation and refining possibilities, and is thus

looking forward to the day when oil of a more desirable quality will be depleted.

Summing up, Leduc-Woodbend and Redwater appear to have established reserves of the order of 500 million bbl. Golden Spike and Stettler appear to offer hope of material addition to the known reserves, but it is premature for us to say how large they are. There is a remarkably large unprospected territory in which similar reserves may exist.

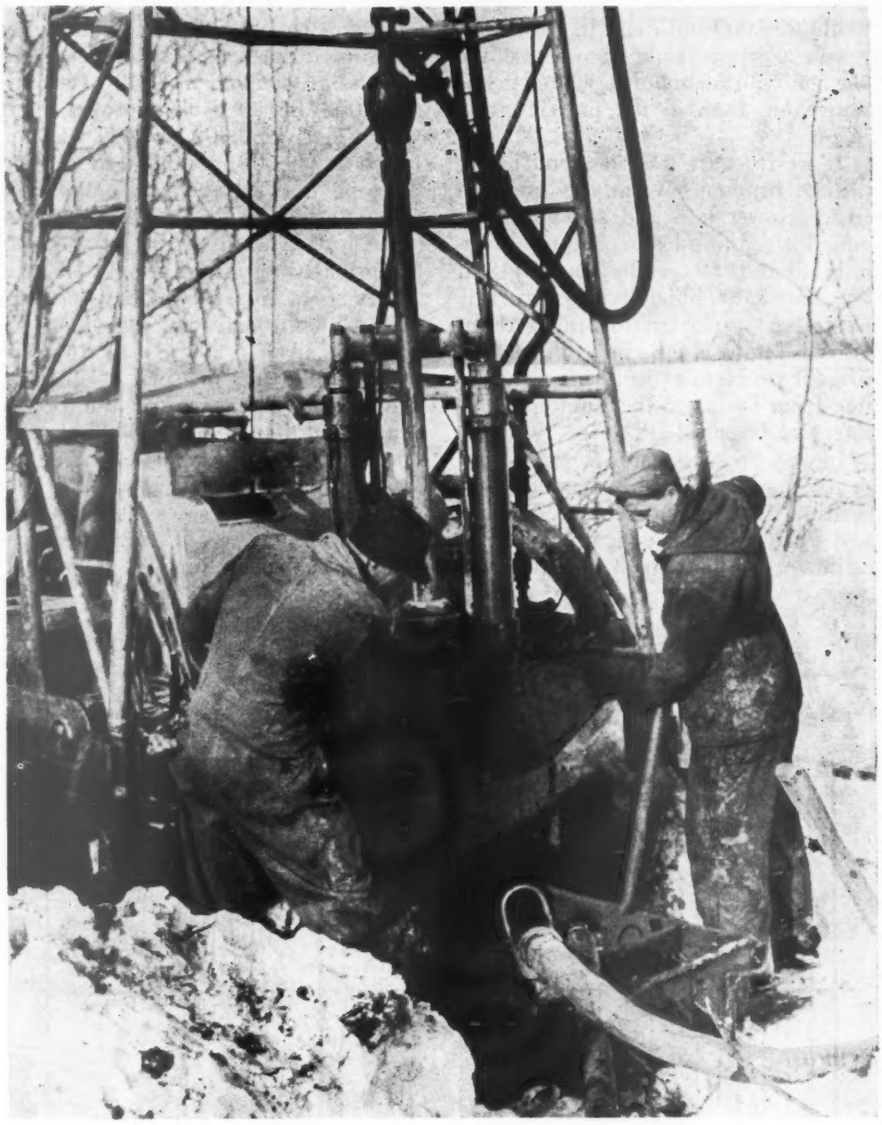
In applying to the Board of Transport Commissioners of Canada for permission to extend its proposed Edmonton-Regina pipe line in to Gretna, Manitoba, Imperial Oil presented as evidence in support of the application a report by Dr. A. I. Levorsen of Stanford University to the effect that Alberta's discovered reserves are 1,000,000,000 bbl and that there are doubtless undiscovered reserves.

Market for Oil

Under existing transportation, refining and competitive supply conditions, the prairie provinces of Alberta, Saskatchewan and Manitoba are the natural marketing area for Alberta oil discoveries. Fig. 2 gives an outline map of Canada which suggests by its distances that Alberta oil could scarcely hope to compete at Halifax with oil brought by tanker from Venezuela, gulf ports of the U. S. A., or from the near east. Montreal can be supplied by tanker to Portland, Maine, and by pipe line from there. Vancouver is also supplied by tankers on the Pacific and the routes from Alberta would involve difficult construction and even more difficult maintenance of pipe lines through canyons subject to slides.

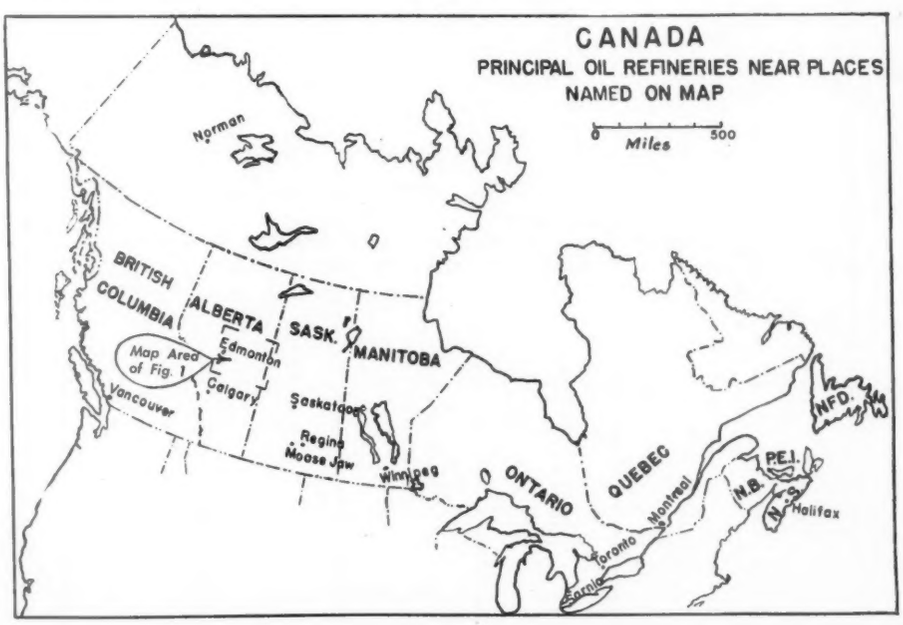
Fig. 3 shows, lower left, that consumption in the prairie provinces in 1940 of petroleum fuels was about 24,000 bbl daily, increasing during the war years in spite of gasoline rationing and reaching about 49,000 bbl daily in 1948. The seasonal nature of the demand is to be noted in Fig. 3, lower right. A peak occurs yearly at seeding time and a second, broader peak comes at harvest, with a very low demand in winter. The large amount of natural gas used in Alberta and the supply of cheap coal from Alberta mines offers little opportunity of winter market for burning oils, but the railways are converting steam locomotives from coal to oil.

The graph in Fig. 3, upper left, shows that for Canada as a whole, gasoline rationing during the war held the line of demand to moderate increase, but demand has increased from about 139,000 bbl per day in 1940 to



Seismic surveys continue all winter. Truck mounted shot hole rig.
Alberta Government photo.

FIG. 2



about 239,000 bbl daily in 1948. The graph at upper right shows that the slackening of demand in winter is less noticeable than in the prairie provinces.

If we forecast 1949 demand in the prairie provinces from the trend in Fig. 3, lower left, and add an allowance for refining loss, it is quite probable that 1949 crude demand will average 65,000 bbl daily. To move this by railway tank cars to prairie refineries is quite a job, but that is our present problem excepting for a pipe line from Leduc to the Edmonton refinery of Imperial Oil.

In the present state of expanding demand and having in view the competitive influences on the Atlantic and Pacific seaboard, it is difficult to estimate just how much pipe line and refining capacity should be designed for use of Alberta oil. With a total Canadian demand in 1948 of around 240,000 bbl per day, probably increasing to 260,000 in 1949 and perhaps to 280,000 or 300,000 by the time a pipe line can be built, and with knowledge that the Atlantic and Pacific seaboards will not be economically supplied from Alberta, there is a suggestion that perhaps 200,000 bbl daily might be an objective. In his address to Imperial Oil shareholders in April, 1949 H. H. Hewetson, Chairman of the Board, suggested that for a 200,000-bbl daily demand, reserves of 2,000,000,000 bbl should be in sight. This suggests that in aiming at increases in marketing area, consideration of proved reserves should be kept in mind.

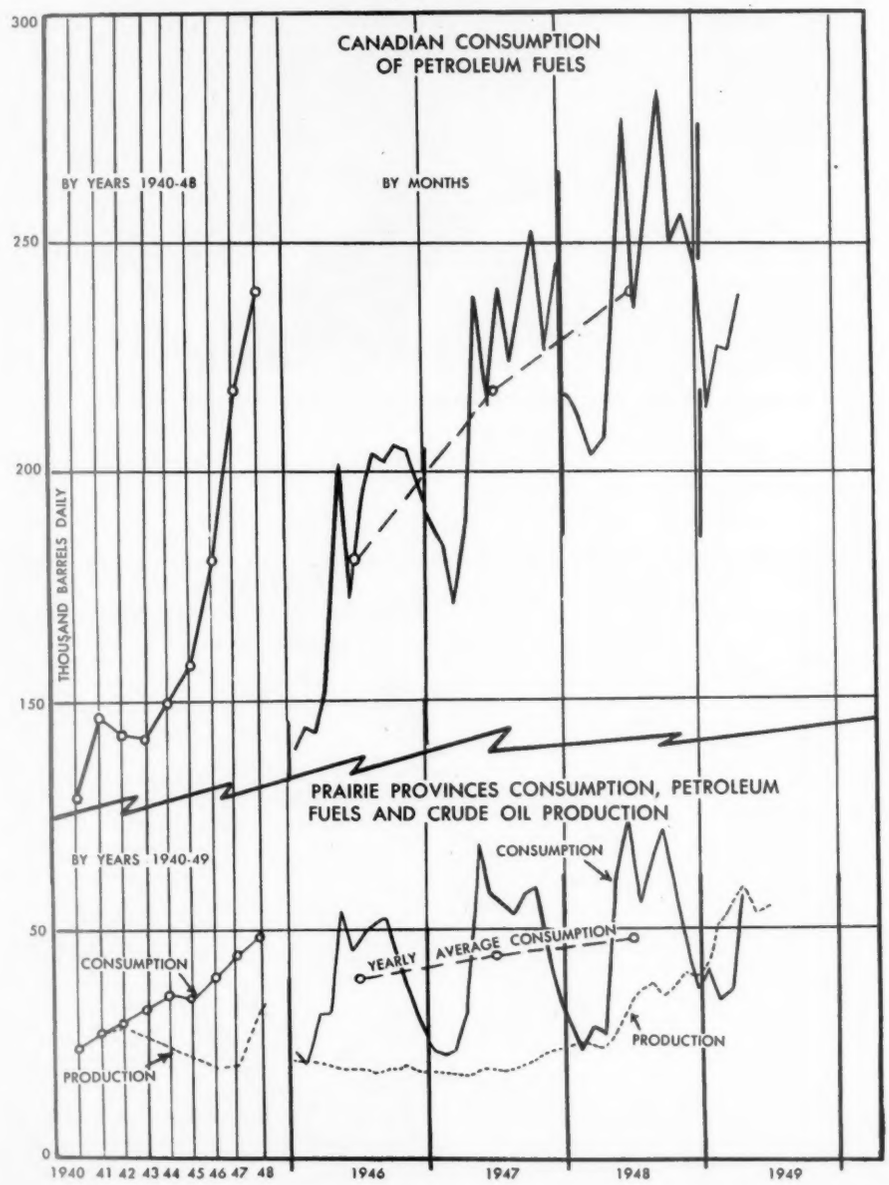
TABLE 1. Canadian petroleum supply and demand· Quantities in barrels.

	1948	1947
Refinery receipts		
Canadian Crude	11,938,561	6,892,963
U.S. Crude	33,070,652	38,809,051
Other Crude	44,265,487	30,918,863
Total Crude	89,274,700	76,720,879
Blending Stocks	2,686,876	3,339,996
Net Imports refined fuels	16,927,233	15,111,266
Total Crude and refined fuel	108,888,809	95,772,141
Consumption Petroleum fuels	87,612,124	79,526,478
Difference	21,276,685	16,245,663
Decrease (increase) Crude Stocks	(—2,037,711)	91,116
Decrease (increase) Refined Stocks	(—1,107,451)	(1,346,924)
Decrease (increase) Unfinished Stocks	(— 779,513)	56,243
Less lubricants, asphalt etc. shipped	(—6,836,742)	(6,373,325)
Apparent refining loss	10,515,268	8,672,773
Refining loss as per cent throughput	12.5	11.3

TABLE 2. Prairie provinces petroleum supply and demand.

Refinery Receipts	1948	1947
Canadian Crude	11,415,062	6,762,881
Imported Crude	5,118,073	7,297,068
Total Crude	16,533,135	14,059,949
Add blending stock	529,037	517,704
Imports refined fuels		
Other Canadian provinces	2,246,814	3,015,433
From U.S.A.	554,186	559,970
Total	19,863,172	18,153,056
Consumption, petroleum fuels	17,771,891	16,242,534
Difference	2,091,281	1,910,422
Decrease (increase) in crude stocks	17,088	43,606
Decrease (increase) in refined stocks	(—2,997)	(48,124)
Decrease (increase) in unfinished stocks	(—76,470)	32,617
Less asphalt shipments	(—590,301)	(504,459)
Apparent refining loss	1,438,601	1,434,062
Refining loss per cent of throughput	8.7	10.2

FIG. 3. Canadian consumption of petroleum fuels.



Pipe Line Developments

Imperial Oil announced a proposed pipe line from Edmonton to Regina over a year ago. In the meantime aerial reconnaissance and photo mosaics of the proposed route have been made, and ground surveys have followed up. Proposed diameter of pipe has been increased in the planning and the terminal is now expected to be in the vicinity of Duluth, Minnesota, or Superior, Wisconsin. It would appear that a United States terminal has been selected rather than a Canadian terminal at or near Fort William or Port Arthur because of the very costly construction involved in crossing the Canadian shield with its alternating muskeg and rock exposures. Evidence given to the Board of Transport Commissioners by Imperial when applying for permission to extend the pipe line indicated an estimate that an all Canadian route would cost $10,000,000 more than to a United States port on the lakes. Pipe was in short supply

when the plans were first started, and steel procurement was arranged through the Dominion Government. Fabrication of welded 16-in. pipe was started in eastern Canada. Since that operation started sights were raised to 20 in. diam from Edmonton to Regina. The 16-in. pipe already fabricated will be used from Regina to Gretna, Manitoba, (on the International Boundary south of Winnipeg) and 18-in. is proposed from Gretna to the terminal.

By using a little more pressure the 16-in. section will carry the same capacity as the 18-in. Six pumping stations are planned on the start with capacity Edmonton to Regina of 95,000 bbl daily which, by adding pump stations, can be stepped up to 136,000 bbl daily. Beyond Regina the capacity will be about 60,000 bbl daily, but to be operated only in the open season on the lakes of about 7 months yearly. Oil will go through in bond for delivery by lake tankers to Imperial's 53,000-bbl daily refinery at Sarnia. Since the pipe line will be a common carrier it is presumed that oil may also go to other Canadian refineries in bond, and it will be available for U. S. purchasers. Construction is to start this fall with expected deliveries to Regina some time in 1950 and it is hoped that deliveries to lake tankers may start with opening of navigation in 1951. Financing of the pipe line program is arranged. As we write there are presumably many problems yet to be worked out.

This method of operation will call for drastic proration of production during the winter. From the standpoint of military security of this continent we would have been happier had the plans called for a route that could be operated throughout the year. Reciprocal trade in oil as between Canada and the United States would benefit both countries. Last year Canada bought 50,000,000 bbl of oil from the United States of which a third was refined fuels. If Canada could supply parts of the United States that are within economic reach of Alberta oil and let United States supplies go to parts of Canada that are within more economical shipping range of U. S. supplies, everyone would be served with cheaper oil, and facilities would be provided for expediting defense of the continent in case defense is suddenly needed.

Canada is probably the best customer the United States has, and Canada would buy even more from the United States if only the balance of trade could be evened up. Oil appears to be one of the commodities that could help to restore the balance. Canada is asking no loans or gifts from the American taxpayer to find and develop her oil, though we must admit that American companies are lavishly spending their corporate funds in the search, and much of the Canadian oil seeking wider markets actually belongs to American companies who have spent their money in good faith to find it.

In favor of lake transportation is the fact to be noted in Fig. 3, that winter demand drops off, so that the decrease in deliveries to eastern refineries, that comes with the close of navigation will coincide with the decrease in demand. Furthermore, once oil is delivered to lake tankers it becomes susceptible of delivery anywhere on the great lakes. There are refineries not far from Toronto with a considerable refining capacity, although their aggregate capacity is less than Imperial's 53,000 bbl daily at Sarnia, and of course lake tankers could also supply U. S. refineries close to the lakes.

TABLE 3. Alberta exploration and development drilling, 1948 and first half of 1949. Number of wells completed.

	Oil		Gas		Condensate		Dry		Total	
	1948*	1949	1948*	1949	1948*	1949	1948*	1949	1948*	1949
EXPLORATORY										
Outposts	10	9	5				10	4	25	13
New Pool Wildcats	2	1					6	4	8	5
Deeper Pool Wildcats	1						1		2	
New Field Wildcats	8	16	6		1		99	73	114	89
Total Exploratory	21	26	11		1		116	81	149	107
Thousand Feet of hole									615	474
DEVELOPMENT										
Turner Valley	5	2					2		7	2
Leduc Blairmore	5	4								
Leduc D-2	32	26					10		149	99
Leduc D-3	102	69								
Redwater		53		2						55
Brooks							1	1	1	1
Camrose								1		1
Dina		2					1		1	2
Duvernay								1		1
Lloydminster	31	12	2				3	2	36	14
Pouce Coupe			1						1	
Princess	2						1		3	
Taber	4								4	
Vermilion			2				2		4	
Viking-Kinsella			3	4					3	4
Total Development	181	168	8	6			20	5	209	179
Thousand feet of hole									911	931
Total Wells	202	194	19	6	1		136	86	358	286
Total Thousand feet of hole									1526	1405

*First half.

TABLE 4. Canadian prairie oil production (barrels).

	1948				1949			
	Alberta	Sask.	TOTAL	M.Bbl/day	Alberta	Sask.	TOTAL	M.Bbl/day
January	687,447	73,753	761,200	24.56	1,280,086	51,732	1,331,818	42.96
February	665,724	66,025	731,749	25.23	1,352,129	51,942	1,404,071	50.14
March	709,099	56,664	765,763	24.70	1,651,012	59,291	1,710,303	55.17
April	702,688	37,791	740,479	24.68	1,714,049	74,891	1,788,940	59.63
May	804,531	57,334	861,865	27.80	1,581,619	90,812	1,672,431	53.95
June	900,508	83,584	984,092	32.80	1,591,260	82,500	1,673,760	55.79
HALF YEAR	4,469,997	375,151	4,845,148	24.56	9,170,155	411,168	9,581,323	52.93
July	1,034,437	95,984	1,130,421	36.46				
August	1,104,113	93,749	1,197,862	38.64				
September	978,018	80,757	1,058,775	35.29				
October	1,076,512	74,620	1,151,132	37.13				
November	1,139,160	79,549	1,218,709	40.62				
December	1,171,346	47,285	1,218,631	39.31				
YEAR	10,973,583	847,095	11,820,678	32.33				

NOTE: Saskatchewan figures are from Dominion Bureau of Statistics.

Prairie Refining Capacity

For some years quite a portion of the prairie provinces market has been supplied with refined products from eastern Canada via lake tankers to Fort William and rail from Fort William. As at the start of 1949, refineries in the prairie provinces designed for white products had a throughput capacity of about 54,000 bbl daily. In April a fire in Imperial's Regina refinery cut off an estimated 7000 or 8000 bbl daily for several months, but that damage has been repaired. The Edmonton refinery, which Imperial had moved from Whitehorse and put on stream in July, 1948 at about 4000 bbl daily, was enlarged to about 6500 bbl daily by the start of 1949 and is now reported handling up to 21,500 bbl daily. Total refining capacity for the prairie provinces is now about 68,000 bbl daily, but the average throughput for the year will be considerably under that figure due to lateness in the year of increase in

capacity. There is additional capacity for cleaning black oil for the market and for manufacture of asphalt, and these plants have a nominal capacity of some 10,000 bbl daily, but they are limited in throughput by the demand for bunker fuel and asphalt, and their functions do not correspond with those of refineries making white products.

McColl-Frontenac is the Canadian partner of Texaco and they purchased a site at Edmonton and announced plans to build a 10,000 bbl refinery, but ground is not yet broken and it appears improbable the plant will affect the refinery situation in 1950.

Exploration and Development

Table 3 gives the principal statistics of Alberta drilling for 1948 and the first half of 1949.

Footage drilled in 1948 was nearly double that of 1947, which in turn was more than double that of 1946. Footage for the half of 1949 was not equal to the whole of 1948, but approached it, so the rate appears to be nearly double that of 1948.

It is of interest to note that over a third of the wells drilled in the first half of 1949 can be classed as exploratory. Considering the pressure to develop the prolific Redwater field, this is a very good exploratory effort, but there is still almost an empire of unexplored or inadequately explored oil country to be looked into in Alberta alone.

Preceding actual exploratory drilling is an elaborate study of the country by geological and geophysical methods. At last report 92 seismic parties are at work in Alberta as well as some in Saskatchewan and Manitoba. Drill cuttings have been bottled from most exploratory wells and from some development wells for the past 20 years or more and are available for study by company geologists at the laboratory of the Petroleum and Natural Gas Conservation Board in Calgary. Electrologs are also available as photostats (if on file with the Board) for wells one year or more old. Some companies have used test hole drilling to develop structure instead of seismic surveys, or to amplify seismic results, and one company has gone in for slim hole drilling as a means of getting information. Some gravity meter and magnetometer surveys have also been made.

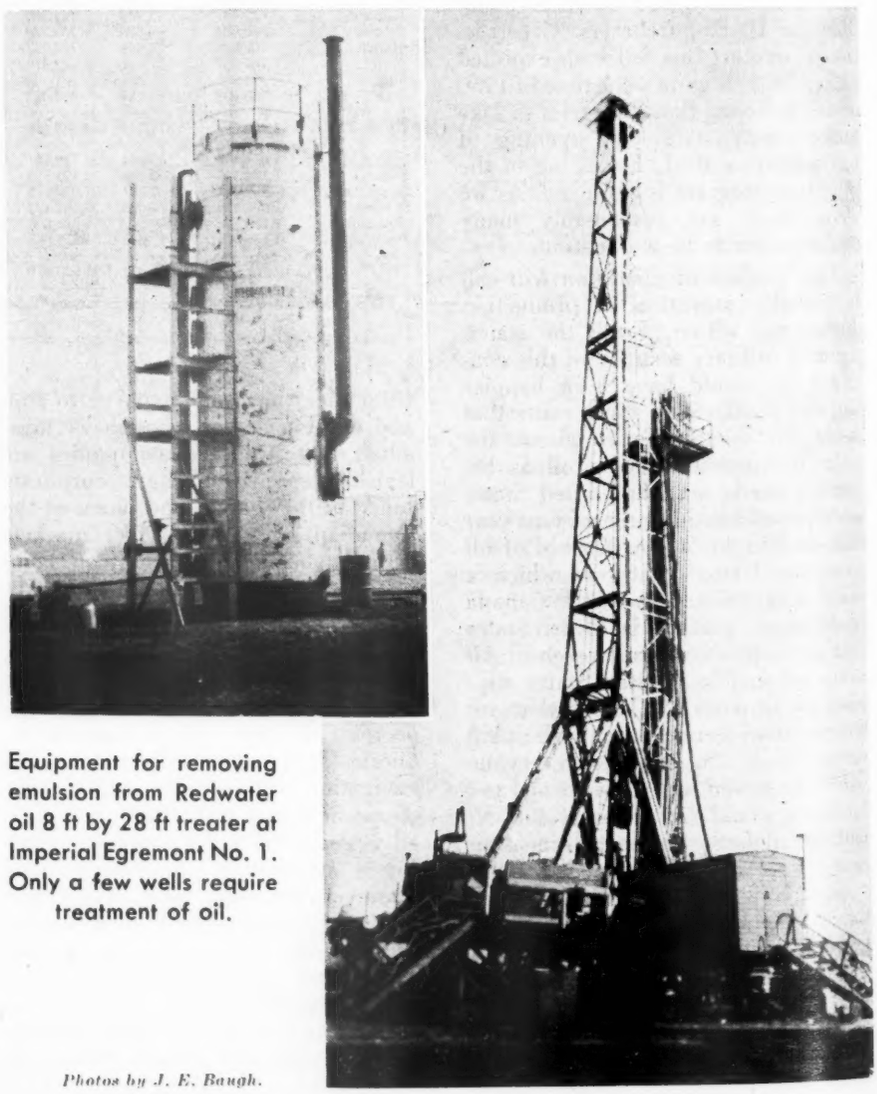
The Province of Alberta owns about 90 per cent of the oil and gas rights in Alberta, and the same is more or less true for Saskatchewan and Manitoba. There is not so much oil country in British Columbia but it is probable that the province also holds most of the rights in land where oil and gas might be expected.

In Alberta the Provincial Government has regulations under which reservations may be taken for a limited time. With extensions a reservation may be held for about two years and on terminating the reservation the holder may relinquish it entirely, or may lease up to half the area, but with restriction as to the amount held in a solid block. If oil is discovered the selection must be made within three months or before drilling a second well on Crown land within 4½ miles of the discovery. An equal area is set aside as Crown Reserve, and the Government has offered Crown Reserve parcels to the highest tender, usually with the right to reject any or all tenders. This system of handling leasing has given the discoverer quite a block of land surrounding a discovery —9 sections that are three miles square or 8 sections, 2 by 4 miles— and it has also provided proven oil land for sale by the Government. In Redwater two choice sections were sold for over $3,000,000 each. One quarter section brought over $900,000. The Alberta taxpayer has thus found himself directly interested in the oil resources of the province.

Some of the larger companies have found themselves carrying enough reservations, either obtained directly or by subsidiaries or employees, and have found enough interesting anomalies to embarrass them and have been farming out some of the leases for drilling by others.

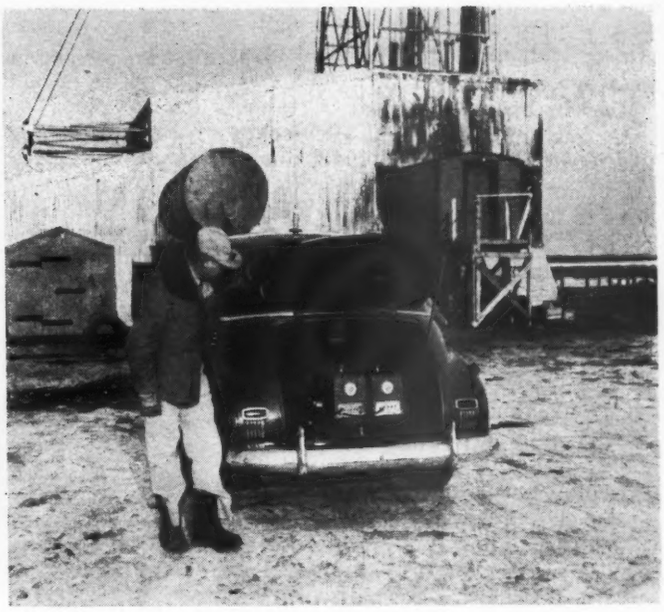
It is rather difficult to say just how much land is held under reservation and/or lease at any moment, for some reservations are being relinquished without selection of lease and others

One of Parker Drilling Company rigs, right, drilling Imperial Amelia No. 3 in Redwater field. Took 25 days to 3319 ft but needed another 22 days before rig released. Now that more is known of the field, drilling is faster. Some wells have been drilled in 12 days, rig released next day.



Equipment for removing emulsion from Redwater oil 8 ft by 28 ft treater at Imperial Egremont No. 1. Only a few wells require treatment of oil.

Photos by J. E. Baugh.



Two way FM radio in field office, left. Served by 95 ft mast aerial with 250 output. Usually reaches toolpusher's car 35 miles but may pick up similar installations in Texas. In the tool-pusher's car, radio has 60 w output. Can keep in touch with office up to 35 miles; talks to other cars 10 miles away. G. A. Wright at car. *General Petroleum photos.*

are being taken up all the time, but a glance at a map on which reservations have been marked leads one to wonder where a likely spot can be picked. Fortunately, a bona fide customer can be dealt with at a central point, and if he finds nothing of interest available at the moment, there are numerous opportunities for him to try a farm-out, taking advantages of preliminary work done by others.

Export of Gas

Several applications were made last year for the right to pipe gas out of Alberta. One contemplated piping Alberta gas to Winnipeg and intermediate cities. Another contemplated taking gas from the northern part of the province to Vancouver, with southward extensions along the Pacific Coast. Another contemplated a pipe line via the Crowsnest Pass through Spokane to Seattle, Portland, and Vancouver, B. C. with a branch to Trail, B. C. smelter.

The problems related to export of gas are rather contentious politically, for once money has been invested in transmission and distribution lines and in consumers' appliances, some obligation to ensure continuity of supply ensues, and the people of the province would look with apprehension on being deprived of gas supply because of export.

For these and related reasons, the Alberta Government set up a commission late in 1948, the terms of reference requiring that there be inquiry into presently known and probable reserves of gas; into present and probable future consumption in the province; and into related matters, and to report their findings. The Dinning report, (from the chairman, R. J. Dinning) was laid before the legislature before the close of its regular 1949 session. It was dealt with in a special sitting held in July, when an act was passed authorizing the Petroleum and Natural Gas Conservation Board to exercise advisory authority under the Government. The Premier has stated that it has not as yet been deemed possible to export gas, but the door is not closed against export should it be considered at some future time that adequate reserves have been established.

Other Canadian Developments

Saskatchewan. In the district near Lloydminster and extending southeast for about 20 miles considerable black oil has been developed, and in the past year several scattered wells have found isolated occurrences that may mark new pools. In the meantime, until the new Imperial refinery at Edmonton had adequate cracking equipment, a considerable supply of bottoms obtained from skimming Leduc and Redwater crude had to be disposed of, and these bottoms cut into Lloyminster crude market. This meant serious restriction on Lloydminster production. Lloydminster producers set up the Lloydminster Petroleum Association, which has been actively trying to enlarge the market for black oil and with some success. The railways are installing oil burning equipment on steam locomotives, and oil storage at divisional points.

Outside of the Lloydminster area exploratory drilling has been at a low ebb but the Government has assured the industry that oil will not be socialized, and a number of companies have taken up reservations along lines somewhat parallel with Alberta. Some geophysical and geological work is proceeding and it is probable that some exploratory drilling may follow. The Minister of Natural Resources for Saskatchewan, J. H. Brocklebank, announced early in September the appointment of J. K. Swanson as administrator of petroleum development and remarked that "practically all potential Crown petroleum lands are under agreement for exploration development."

Manitoba. One or two wildcats have been drilling in the southwest corner of the province. A showing near Minot, North Dakota, caused a leasing flurry that affected both Saskatchewan and Manitoba.

Eastern Canada

In eastern Canada the greatest part of the exploratory activity has been in southwestern Ontario where 61 exploratory wells were drilled in 1948 with two small oil discoveries and 5 gas discoveries. This year a two-mile step out from the Kimball field found the biggest flow of dry gas recorded in Ontario in the past decade when the Payne well showed an open flow of 40 million cubic feet daily. Natural gas occurrences in this densely populated province that has no local coal are most welcome and a gas field is of economic importance. The Becher field has been developed by perimeter drilling and at last report its yield has

been stepped up to 450 barrels daily, which is about double the yield of a year ago.

In New Brunswick, Shell Oil Company has one rig drilling after completing two dry holes in 1948. Some exploratory drilling has also been done to the south of the Stony Creek field of New Brunswick and in the Gaspé peninsula of Quebec.

Price of Oil

On December 1, 1948, there was a general price cut. In announcing the price reduction Imperial Oil pointed out that a large part of the products manufactured from purchases during the winter must wait for spring to be marketed, and it was felt advisable in view of expanding production to buy at lower prices.

Turner Valley average gravity of about 41 deg dropped 43 cents from $3.68 to $3.25. There is a sliding scale increasing 2 cents per degree above and decreasing 2 cents per degree below. Leduc price was dropped 52 cents ($3.47 to $2.95); Redwater price dropped 52 cents ($3.20 to $2.68); and, other fields except Lloydminster-Vermilion saw some adjustment at the same time.

A few days later British American posted prices for Turner Valley 15 cents above the Imperial - Royalite posting, and 10 cents above Imperial for Leduc and Redwater.

On June 22, 1949, Husky posted a general cut of 20 cents in Lloydminster crude price, making crude worth about $1 to the producer. The exact value to the producer, however, depends on per cent BS&W cut and hauling charges, which depend on distance and which are on gross quantity hauled, thus penalizing large BS&W cut.

Pipe line and loading charges add to f.o.b. cost of oil about as follows: Turner Valley, 15 cents; Leduc-Woodbend, 10½ cents; Redwater, 11 cents; and clean oil from Lloydminster costs about $1.27 f.o.b. cars.

More details respecting costs, revenue to producers, individual well production by months and cumulative, and many other items connected with the industry are contained in the Conservation Board's "Alberta Petroleum Industry 1948."

Pending completion of pipe line facilities that will enable Alberta producers to make a material enlargement of their marketing area, further cuts do not at the moment seem imminent. Imported crude at the fringe of the present market area costs materially more than Alberta crude as laid down at refineries. When deliveries start reaching the lakehead by pipe line the situation will change and the price will reflect laid down cost at points where the oil becomes competitive at the fringe of the enlarged market area.

A few wells on the southwest flank of Redwater field must be pumped; most wells flow. The pay gets rather thin along the edge. *Photo by J. E. Baugh.*

Allowable Production and Proration

The Petroleum and Natural Gas Conservation Board sets allowable production based on maximum efficient rate. For Turner Valley the Brown plan still applies, based on total reservoir displacement of gas, oil and water produced and purchasers have not reduced takings below these allowables. For Leduc, D-3 wells are allowed 150 bbl daily, D-2 and Blairmore wells are allowed 100 bbl daily. For Redwater the allowables are 450 bbl per day except for a few wells that voluntarily accepted smaller ones.

Starting April 6 Imperial reduced acceptances and British American shortly after reduced their acceptances. The exact amount has varied from time to time. For most of the subsequent period acceptances were reduced as new wells came into production, but on September 1 Imperial was able to increase acceptances a bit as a new refinery unit came into action and as of that date takes 135 bbl per day from Redwater, 115 from Leduc D-3, and 80 from Leduc D-2 or Blairmore, 325 from Golden Spike.

General Information

Calgary, Alberta, has head offices of most companies engaged in production, development and exploration, or if the company's head office is in the United States, its local headquarters is in Calgary.

The Western Canada Petroleum Association acts as a clearing house for many business and public relations contacts, with office in Lancaster Building, Calgary. The Oil Bulletin, published daily by C. O. Nickle, Lancaster Building, is a mimeograph sheet, carries full coverage of daily happenings in oil. The Western Examiner, Calgary, published weekly, is devoted entirely to oil and gas. The Petroleum and Natural Gas Conservation Board, 514-11th Avenue West, Calgary, receives applications for license to drill wells, collects geological data, publishes weekly estimates of oil production, and drilling reports, monthly and yearly reports, and a Schedule of Wells drilled for oil and gas in Alberta. Maps, etc, are also produced.

Any of the chartered banks can be depended on for financial service. Royal Bank of Canada, Calgary, has a special service on oil. There are several reputable brokerage houses with private wire connections to eastern correspondents. Most of the drilling is done under contract, with quite a choice of contractors. Seventy rigs were working in the week of August 29, and one or two contractors have up to a dozen rigs each, although fewer rigs to the contractor is more usual.

Nickle Map Service, 513 Eighth Avenue West, Calgary, specializes in oil maps including lease and reservation maps. Reservations and leases of Crown lands are dealt with by the superintendent of mining lands, Edmonton, Alberta. Canadian Pacific Railway lands are handled by the C.P.R. Department of Natural Resources, Calgary, and Calgary and Edmonton lands are handled by an office in Canada Life Building, Calgary. * * *

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Typical is this picture of the replacement of an old "Standard" rig with a modern, efficient, economical LUFKIN PUMPING UNIT.

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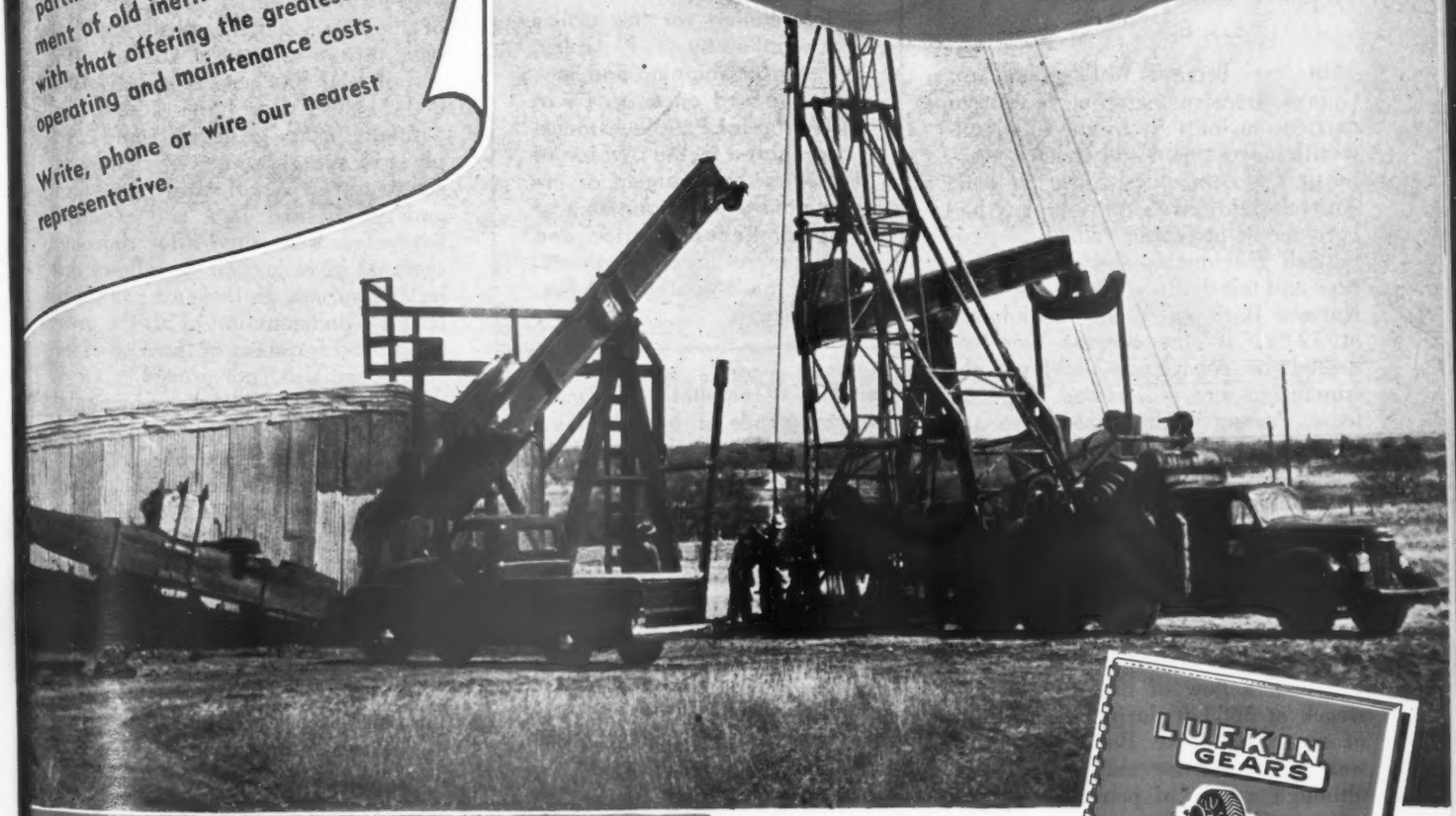

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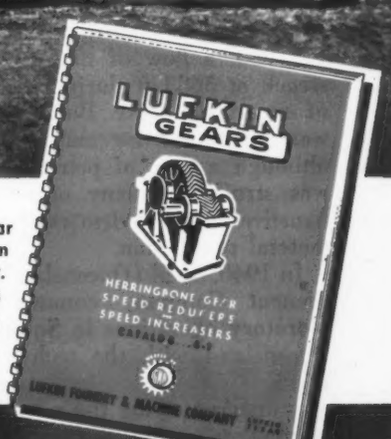
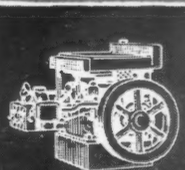


LUFKIN PUMPING UNITS



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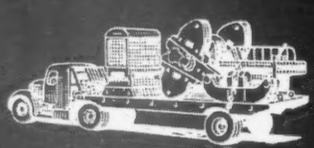

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Australian Petroleum Industry

No large deposits of crude petroleum have yet been located in Australia or the Territory of Papua-New Guinea. A very small quantity of oil has been recovered in Victoria. Seepages of oil and gas were first reported in Papua and New Guinea in 1911, and additional seepages have since been discovered. Occurrences on the mainland have in general been limited to minor flows of natural gas, principally methane, and small amounts of oil, wax, and natural gas encountered in water bores. Small deposits of wax and bitumen have also been found at the surface in different localities.

Prior to 1942, the principal areas of oil exploration were Papua and New Guinea, Southern Queensland and the Gippsland district in Victoria.

Papua

In the Territory of Papua-New Guinea intensive operations have been carried out, initially by the Commonwealth Government and in later years by private companies. Since the war, Australasian Petroleum Company has been the principal operator with geological, gravimetric and seismic surveys and test drilling. This company's Kariava Bore was finally abandoned at 12,621 ft—the deepest hole yet drilled in Australasia—without encountering any indications of petroleum. Present drilling operations are being carried out at Oroi, near Yule Island, and at Upoia and Hohoro on the Vailala River.

Queensland

In Southern Queensland, the history of the search for oil is particularly interesting because of the discovery of petroliferous gas at Roma. In 1900, a flow of natural gas was struck at 3683 ft during the drilling of an artesian bore. Boring activities were continued for many years and although a flow of petroliferous gas was struck on many occasions, exhaustive tests failed to establish commercial production.

In 1940, Shell (Queensland) Development Company commenced exploratory operations in Southwestern Queensland with the technical staff previously employed in Papua. Work was interrupted by the war, but was later recommenced on a larger scale with geological surveys and scout boring in the Mt. Rolleston area, southwest of Rockhampton. A promising geological structure has been delineated at Warrinella and the company has imported a drilling rig rated for 10,000 ft to make a deep test. Other operations conducted since the war include geophysical surveys by the Commonwealth Bureau of Mineral Resources, Geology and Geophysics in the Roma district. The work is still in progress.

Victoria

In Victoria, the principal activity in oil drilling has been at Lakes Entrance by the Commonwealth Government, the Victorian Department of Mines and private companies. Inconsiderable quantities of comparatively gas-free, low-grade crude oil have been recovered incidentally to these drilling operations.

Information for this article was supplied by W. P. Ashley, Minister for Shipping and Fuel, and is based on a review of the Australian Petroleum Industry prepared by the Division of Industrial Development of the Commonwealth Department of Post-war Reconstruction and on a general article by an officer of the Shipping and Fuel Department.

In other parts of Australia, petroleum exploration prior to 1942 was carried out on a smaller scale. Bores were drilled in the Hunter River, Sydney-Gosford, and Grafton districts of New South Wales, in the Mersey Valley district of Tasmania, in South Australia, and in the Kimberley district of Western Australia.

Exploratory operations since the war include extensive geophysical surveys in the Lake Frome area by Frome Broken Hill Pty. Ltd., followed by drilling of a test bore to 3256 ft at Kopperamanna in South Australia. Private companies have also been carrying out large-scale geological investigations in the Northern Territory, and in the Northwest Basin and Kimberley districts of Western Australia, and a Commonwealth geological party is investigating Dampier Land, the Kimberleys area, and the Northwest Basin. Geological conditions in these areas are considered to be favorable to the accumulation and retention of petroleum, and further large-scale operations are projected.

Surveys

The comprehensive nature of the search for oil now in production is shown by the following figures for surveying activity in 1948 in crew-months.

	Australia	Papua-New Guinea
Seismic Surveys	—	2
Gravity Surveys	8	12
Magnetic Surveys	8	6
Geological Surveys	56	70

Since the commencement of exploration, at least 268 test-wells have been drilled with an aggregate depth of about 463,200 ft, and the total expenditure on the search for oil to the end of 1948 has been at least £7,500,000. Most of these bores were drilled without prior geological and geophysical survey, some others were located on the basis of scanty geological and geophysical data, and comparatively few were sited after thorough regional investigation. It follows that lack of success in the past cannot be held as condemnation of all the areas tested, and for many of these areas the verdict remains "not proved."

Although commercial production of oil in Australia and the Territories is still awaited, there is strong hope that eventually oil fields will be discovered. All the conditions considered essential for the occurrence of oil in commercial quantities are present in Papua; seepages in the formations being tested provide proof of the presence of oil, and commercial production has been achieved in Dutch New Guinea. Conditions on the mainland are less promising than those in Papua, but they are good enough to warrant thorough investigation. Geological petroleum structures are known to exist in Queensland and the presence of petroliferous gas and traces of oil have been proved in the vicinity of Roma. Extensive sedimentary basins with a considerable thickness of marine sediments exist in Western Australia, and oil occurs in the Tertiary rocks of Victoria and sediments of the same age are found in the Portland-Nelson-Mt. Gambier district of Victoria-South Australia.

* * *

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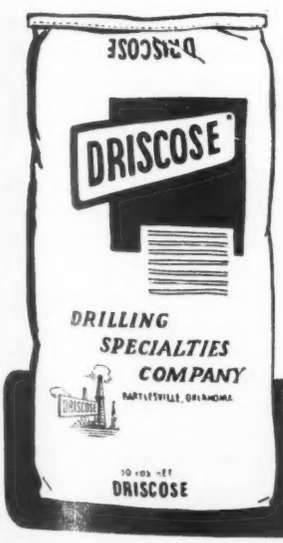


*DRISCOSE is a trademark for Sodium Carboxymethylcellulose

DRILLING SPECIALTIES COMPANY

BARTLESVILLE, OKLAHOMA

The *Aminoil*, an LST converted into an air-conditioned floating base of operations for drilling on American Independent's concession in the Kuwait-Saudi Arabia Neutral Zone, is being loaded at a dock at Orange, Texas, preparatory to its 12,500-mile trip to the Persian Gulf.

Floating Base for Kuwait Drilling Rig

THE loading of a converted LST (landing ship, tank), which will be used in oil well drilling in Kuwait, was begun recently at Orange, Texas. The ship will be used to transport all drilling equipment and supplies over a 12,500-mile route to the Persian Gulf, where it will become a floating base of operations during drilling operations on the first test of American Independent Oil Company's oil concession in the Kuwait-Saudi Arabia Neutral Zone.

Kerr-McGee Oil Industries, Inc., of Oklahoma City and Brown Drilling Company of Long Beach, California, have contract for the drilling operations. The first well will be south of the prolific Burghan field, which is located in Kuwait proper, and south of the town of Kuwait.

Concession on the Kuwait-Saudi Arabia Neutral Zone is held jointly by American Independent and J. Paul Getty (Pacific Western Oil Company). American Independent has a lease on the Sheik of Kuwait's undivided one-half interest and Getty has Saudi Arabia's undivided half interest in the Neutral Zone of about 2500 sq. miles.

For the drilling operation, Kerr-McGee and Brown will use an adaptation of the method developed by Kerr-McGee for drilling in the offshore area in the Gulf of Mexico. Kerr-McGee pioneered the use of a drilling tender in combination with a small rigid platform in the offshore area, using the drilling tender for crew quarters, storage of pipe, drilling mud, etc.

For the Kuwait operation, the LST will have no direct connection with the drilling rig, serving only as an operations base, as home for the crew members, and as a warehouse.

Conversion of the LST was completed recently and it has been given a preliminary inspection. Parts of the boat used by crew members have been air-conditioned, including quarters, kitchen, dining room, recreation room, and theater. Laundry and dry cleaning equipment also has been installed.

All drilling equipment and supplies for operations in Kuwait have been assembled at Orange. Loading operations are now underway. The derrick to be used in the operation was erected at Orange, the rig was assembled, and a test hole was drilled before the equipment was dismantled for loading on the LST.

Road building equipment, trucks, personnel transportation vehicles, spare and replacement parts for all engines and machinery are to be transported on the LST.

It was necessary for Kerr-McGee engineers and procurement representatives to plan and purchase equipment, supplies, and food sufficient for a year. All types of canned foods are included, and more than $40,000 worth of fresh meats are being stored in the refrigerated portion of the boat.

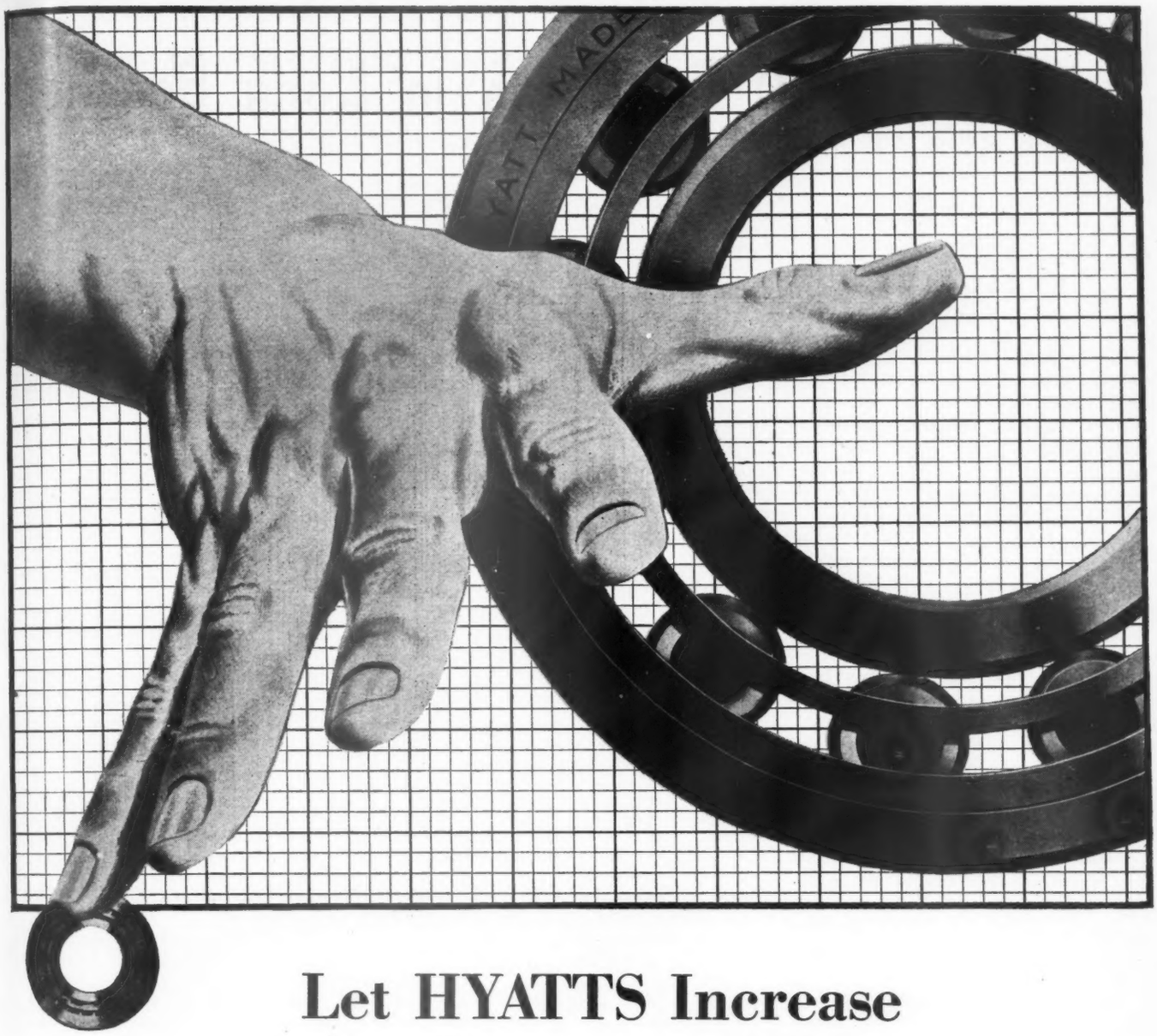
When the boat arrives on the Kuwait shore, road building equipment will be unloaded first to build a road to the drillsite some 20 miles inland. The drilling equipment will then be moved to the location.

After the boat in unloaded, it will be anchored and used as crew quarters, warehouse, and general drilling headquarters.

Dean A. McGee, executive vice president of Kerr-McGee, conceived the idea of using an LST in this dual role. Tom Seale, who was manager of the company's first offshore drilling operations in the Gulf, was project engineer and has been in active charge of the details of outfitting the boat and assembling the equipment and supplies.

American Independent Oil Company is a Delaware corporation formed for the purpose of engaging in foreign operations. It includes the following individuals and oil companies: J. S. Abercrombie, Ashland Oil and Refining Company, Ralph K. Davies, Deep Rock Oil Corporation, Globe Oil and Refining Company, Hancock Oil Company, Phillips Petroleum Company, Signal Oil and Gas Company, and Sunray Oil Corporation. Davies is president

* * *



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HYATT ROLLER BEARINGS

New 10,000 Ft. Boom in Long Beach

MARTIN VAN COUVERING*

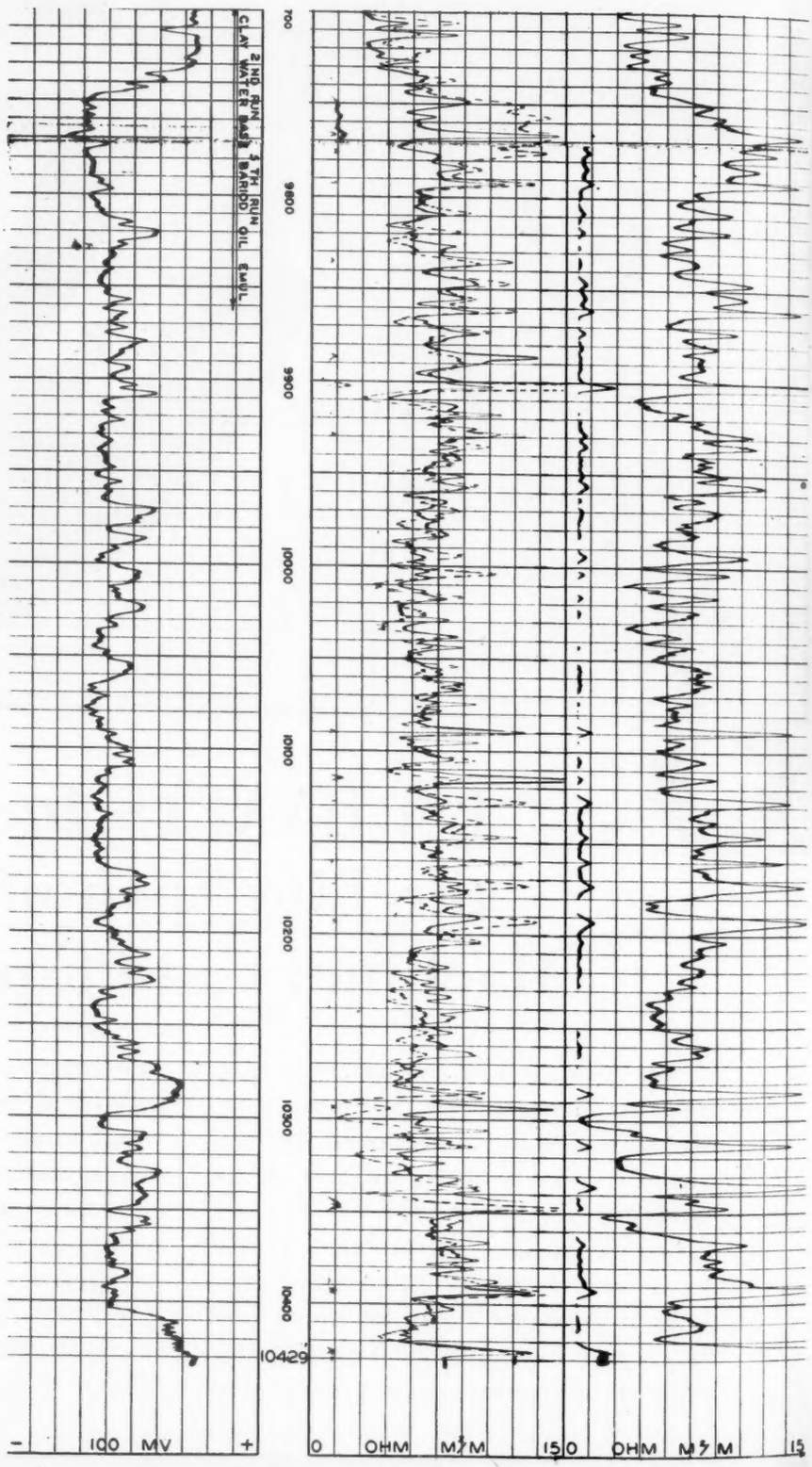
EXCLUSIVE

LIKE the nine lives of the cat, the repeated come-backs of the Long Beach field have surprised everyone concerned. After the initial boom, in the early twenties, when Long Beach oil field was one of the most sensational discoveries in the entire world, it proceeded to repeat the performance a few years later—in 1928-29. A minor outburst, the Los Cerritos extension of 1926, was sandwiched in between. After that, its revivals have not been so showy, but, nevertheless, interesting. What can you expect of a field that has averaged well more than half a million barrels per acre?

The present excitement was sparked by R. W. Jerman's completion of a good producer in the northwestern part of the field from about the same zone in which he had pioneered the exploration and development in the south-central part. This is known as the "De Soto zone," after the company name under which he was operating at the time he made his discovery there—about 900 ft southwest of Willow and Walnut streets.

"Rocky" Jerman (the name is not German, but Irish) is one of those rugged individuals who make up the backbone of the petroleum business and of the private enterprise system in general. His father, an old-fashioned "rope-choker" from Pennsylvania, moved to Taft in 1910, when "Rocky" was still a boy, and when Taft was a rough-and-tumble, frontier town. The boy started working in the oil fields when he was sixteen and got his first drilling job in 1920, with the McKeon Drilling Company. His first acquaintance with Long Beach Oil Field came in June, 1922, when the field was just a year old. His first well was Oceanic No. 2, near Cherry and Anderson. He was a driller on the Coast States well, southeast of Willow and Walnut, at the time of the blow-out of the neighboring Union Oil Company well, "L.B.C." 11.

When John McKeon became manager of production for Richfield Oil Company, he took Jerman with him as driller and tool pusher, and when Mc-



Log of R. W. Jerman No. 1 Victory, Long Beach.

*Consulting Petroleum Geologist.

"IT WAS LIKE THIS . . . *the deeper we went, the tougher the going — but, the joints held tight and the walls stood up*

— because we were using

NATIONAL SEAMLESS

all the way down!"

ONCE a deep-hole man has worked a well with U·S·S NATIONAL Seamless Drill Pipe, Casing, and Tubing and experienced the *freedom from down-the-hole trouble,* he becomes "sold" for life on these superior oil country goods.

As an example of the kind of dependable service you can expect, consider Stanolind's experience in sinking its No. 1 Briscoe Unit in Grady County, Oklahoma, without a single fishing job! Reports state that there was no time lost and no consequential down-the-hole trouble encountered in running the string of 7" O. D. NATIONAL Seamless Casing to a depth of 13,670 ft. and the string of 2-7/8" O. D. NATIONAL Seamless Tubing to 14,190 ft.

Pierced from solid billets of steel, NATIONAL Seamless Tubular Goods have no welds—no line of potential weakness. Furthermore, they have been improved both in steel composition and physical properties to give them higher collapse resistance and increased joint strength—factors which are of utmost importance in these days of deep drilling. For complete data, write National Tube Company, Frick Building, Pittsburgh, Pennsylvania. Ask for a copy of Bulletin No. 15.

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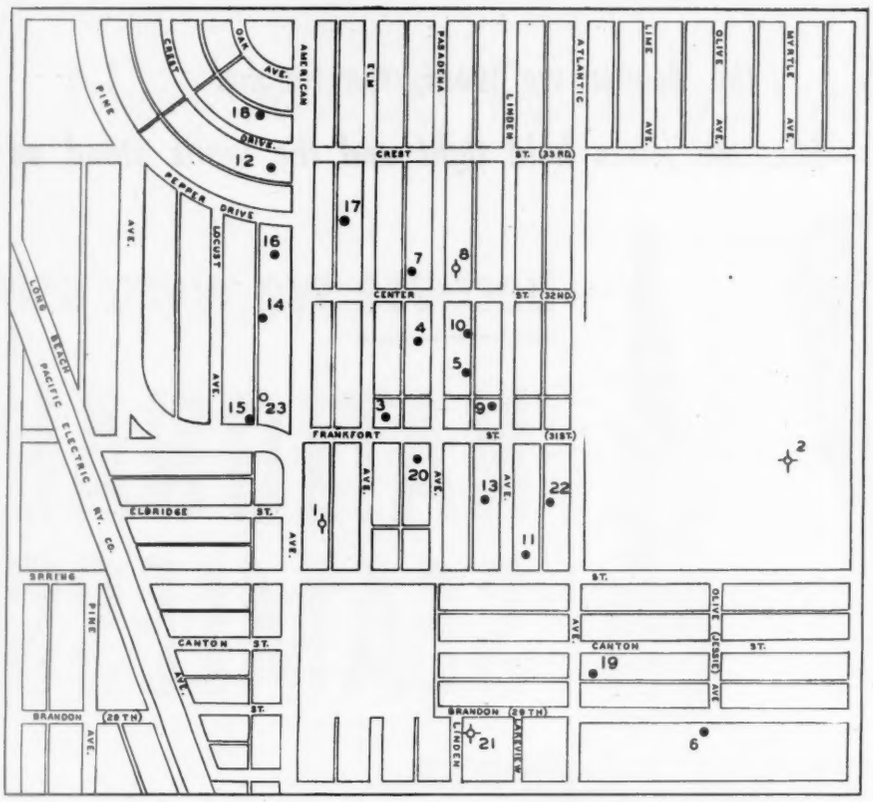

Western part of Long Beach oil field showing wells more than 10,000 ft deep.

Keon left Richfield and helped to organize Italo Petroleum Company, "Rocky" went along.

In 1930, he decided to try his hand as an operator in his own right, and the venture succeeded, so he has been an independent for nearly 20 years.

The development, about which this story is being written, is concerned with a group of wells that are all more than 10,000 ft deep. With a 14,000-ft producer in Wyoming and another well in that State now drilled to more than 20,000 ft, 10,000-ft wells are no longer spectacular. Long Beach had never had a 10,000-ft producing zone, however, before Jerman discovered the De Soto zone. That was in 1938, but it did not create much of a stir.

Back in 1929, Shell Oil Company had attracted worldwide attention by drilling its "Nesa" 11, in this field, deeper than any well had ever been drilled before—9280 ft. A whole year was consumed in the drilling, however, and the well was not productive. This dampened enthusiasm for deep drilling considerably.

The first 10,000-ft well in the Los Angeles Basin apparently was Union Oil Company's Callender 50, drilled in 1937 at Dominguez, but the same year the same company drilled Bell 100 more than 11,000 ft deep at Santa Fe Springs. Taking the lead in Rosecrans and Richfield as well, it drilled the first 10,000-ft hole in each of these fields. This was in 1938. Shell completed one that deep at Dominguez during the same year.

The De Soto well at Long Beach, mentioned above, came a little later in 1938. It was completed on December 8 for 300-bbl daily, and has produced about 300,000 bbl to date. The next year, Jerman completed his "Dormax" well, also more than 10,000 ft deep. Its total production is more than 430,000 bbl. His first competitor was Allied Petroleum Company, which drilled a slightly deeper well, about 200 ft west of the De Soto well, in 1940. A second competitor appeared in 1941, when Union Oil Company completed L.B.C. 19 about 250 ft south of the "Dormax." Meanwhile, El Hondo Petroleum Company had deepened the old Venago well, on the east side of Long Beach Boulevard, just north of Spring Street, to 10,055 ft, but it was not productive.

Then came the war, and no more such deep wells were drilled in this field until 1944, when The Texas Company drilled a 10,000-ft well on its Field lease, between California and Atlantic Avenues. It was a small producer, in the Brown zone, but has now been abandoned. The same year, 1944, Shell Oil Company began the drilling of what is still the deepest well in the field, Alamitos 48A, in the eastern end. It was suspended in January, 1946, at a depth of 14,950 ft without having found production. It is reported to have encountered schist at 14,558 ft. after redrilling. The old hole had a depth of 14,875 ft. This is the only well in the field that had that experience, although quite a few in the neighboring Wilmington oil field have found it. About the same time, Shell was also drilling its Stakemiller Rose well, on the south side of Signal Hill, to a depth of more than 11,000 ft. It, likewise, failed to find deep production.

In 1947, the same company made another deep test—this time in semi-wildcat territory, east of Signal Hill. This well was good for 1000 bbl per day. For some reason, this does not seem to have created enough excitement to precipitate a drilling boom, although it probably did cause the

LONG BEACH WELLS WITH DEPTHS OF OVER 10,000 FEET

Map Number	Company and Lease	Spudded Deepened	Completed Idle	Depth, ft	Producing interval, ft
1	El Hondo Pet. Corp.—No. 1 (Was Venago Oil Corp. Miller No. 1)	8-12-39 from 7,285 ft	12-16-39	10,055	
2	The Texas Co.—Field D-1	9-28-43	12-8-43 (drlg.) Abd. 6-6-48	10,324	Brown zone
3	Jerman, R. W.—Victory No. 1	8-13-48	12-2-48	10,429	9,730-10,429
4	The Hancock Oil Co. of Calif.—Signal 34	1-21-49	3-17-49	10,150	9,507-10,150
5	Acme Drlg. Co.—Bauerdorf No. 1	3-2-49	5-1-49	10,122	9,461-10,122
6	General Pet. Corp.—Brennecke No. 4	3-13-49	5-15-49	10,360	9,755-10,365
7	Herley, Jack and Kelly, Paul—Fee No. 1	3-27-49	6-1-49	10,459	9,435-10,459
8	The Hancock Oil Co.—Signal No. 35	3-30-49	Susp. 6-4-49	10,100	
9	Meeker and Garner—Zephyr No. 7	4-14-49	6-4-49	10,274	9,393-10,274
10	Cunningham, C. D. and Transcal Drlg. Co.—Jacobson Comm. No. 1	4-15-49	6-4-49	10,274	9,395-10,274
11	Signal Oil and Gas Co.—Dutcher No. 3	3-26-49	6-8-49	10,362	9,605-10,362
12	Feldman, D. D.—Feldman-Woolner No. 1	3-21-49	6-11-49	10,503	9,642-10,503
13	Pacific Western Oil Corp.—Cons. Royalties No. 1	4-14-49	6-12-49	10,279	9,776-10,279
14	Atlantic Oil Co.—Dodge No. 3	4-5-49	6-14-49	10,360	9,850-10,360
15	Pray, Max and Walker, Elisha J.—Geo. Duty No. 1	4-22-49	6-17-49	10,433 Plug 10,310	9,935-10,310
16	Pray, Max and Morgan, Fred—Johnson No. 1-A	4-14-49	6-22-49	10,623	9,815-10,623
17	Signal Oil and Gas Co.—Signal-Hancock-Morrill No. 1	4-20-49	6-22-49	10,288	9,515-10,288
18	Cunningham, C. D. and Transcal Drlg. Co.—McKenzie No. 1	4-22-49	6-24-49	10,370	9,608-10,370
19	Gen. Pet. Corp.—Barnesbush No. 5	3-21-49	7-4-49	10,150	9,860-10,150
20	Atlantic Oil Co.—Douglas No. 1	4-29-49	7-7-49	10,450	9,729-10,450
21	Acme Drlg. Co.—Farell No. 2-1	5-24-49	Abd 7-2-49	10,172	
22	Havenstrite Oil Co.—Havenstrite-McKenzie No. 1	4-22-49	7-21-49	10,400	9,320-10,400
23	Stock, Paul—Warburton No. 1	5-22-49		10,089	(drlg. 7-23-49)

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Republic Electric Weld Casing and Tubing are formed only from high ductility steel. Every length is fully normalized for uniform structure. Casing is cold sized for high yield strength—additional assurance of full dependability on every job.

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drilling of three or four more wells to 10,000 ft. General Petroleum Corporation and Pacific Western Oil Corporation each drilled one northeast of Signal Hill, but neither was successful. Shell followed by drilling two more deep wells in the eastern end of the field, and another at the northern edge just east of Cherry Avenue, but they, too, were unsuccessful. The last of these was abandoned in April, 1948.

This brings us to the beginning of the present boom. Our friend, "Rocky" Jerman, started it by bringing in a good well, 10,429 ft deep, at Thirty-first and Elm Streets, a block east of Long Beach Boulevard. This occurred in December, 1948. By March, 1949, Hancock Oil Company had brought in a good well, 10,150 ft deep, in the same block. Then the race was on. At the time of writing, 23 wells more than 10,000 ft deep had been drilled in the area south of Wardlow Road and west of California Avenue. All but four were north of Spring Street and west of Atlantic Avenue. The deepest was 10,623 ft. Only three reported initial productions of more than 500 bbl. Two had been abandoned. Gravities were mostly between 25 and 30 degrees, probably averaging about 28 API, bringing a price of about $2.50 per bbl. Some of the wells were quite free of water, others quite wet.

The average drilling time was a little more than two months. Some wells averaged more than 200 ft per day. The average cost was about $200,000. Thus, this new boom has already cost about $5,000,000. Considering the cost of drilling and the small production, it is doubtful that most of the wells will pay out.

In 1932, the State Division of Oil and Gas published a map of the Long Beach oil field, showing contours on the top of the Lower Brown zone. Since that time, the interpretation of the structure has been modified somewhat, but the map shows a longitudinal fault running through the area under consideration here, from southeast to northwest, and the position of this fault has not been changed very much in the latest interpretation. This fault is now believed to head to the northeast about eight degrees, which means that, if it is not curved, it should be found about 700 ft farther northeast, 5000 ft below the top of the Lower Brown zone. The fault cuts the top of the Lower Brown just north of the intersection of Pasadena Avenue and Thirty-first Street. Directly below that point, the De Soto zone is about 5000 ft deeper, but the fault at that depth is probably about 700 ft farther northeast.

If the hade is greater, as some think, the displacement will be proportionately more. The De Soto zone, in so far as is now known, rises from the southwest toward the fault. Near Locust and Thirty-first Streets, it is about 9900 ft below sea level, while near Pasadena Avenue and Thirty-second Street, it is about 600 ft higher. Whether it continues to rise till it reaches the fault is not known, because no wells have been drilled at locations that would determine this point. Perhaps The Texas Company's Field D 1 was the most favorably located for this purpose, but it was drilled before the De Soto zone had been discovered in this part of the field. As it was drilled deep enough to have made the discovery, it may be presumed that some kind of geological change has occurred to prevent the accumulation of oil in the De Soto zone from extending that far. This idea is supported by the fact that the most northeasterly well of the main group was also unsuccessful, although it was drilled 10,000 ft below sea level, while a well about 135 ft to the west encountered the zone more than 600 ft higher than that, and another well, 200 ft to the south, found it more than 700 ft higher. Both of these were good producers.

This would seem to indicate that the accumulation ends before it reaches the well marked "8" on the accompanying map, which is Hancock Oil Company Signal 35. The Texas Company well referred to above is marked "2" on this map.

Besides rising to the northeast, the top of the De Soto zone seems to slope away rapidly to the northwest and southeast from its high point, which seems to be in the block bounded by Thirty-first and Thirty-second Streets and Pasadena and Linden Avenues. The wells in which the top of the zone is found 9700 ft or more below sea level are those marked "6, 14, 16 and 19" on the map. The two highest on the structure are marked "9 and 10." In those two, the top of the zone is less than 9300 ft below sea level. This will give a general idea of the shape of the structure. It is apparently a knob on the southwest flank of the main Long Beach anticline.

The main "Cherry-Hill" fault, as it is generally known, cuts the "Brown" zone in such a way that the formations on the southwest side are lower than the corresponding ones on the northeast side. The map published in Bulletin 118 of the State Division of Mines (1943) shows the minus-3900-ft contour as the highest on the southwest side. Opposite this place, the minus-3150-3650-ft contours occur on the northeast side. The relation is not uniform, as the structures on the two sides are quite different. Nevertheless, the southwest is uniformly the "downthrown" side.

If this relationship persists at greater depths, the De Soto zone may be found at shallower depths northeast of this fault than in the area now developed. The Texas Company Field D 1 intended to explore this possibility but was unsuccessful in finding oil at that depth. No doubt, others will try it. Hancock Oil Company has located a well near Thirty-seventh and Cedar Streets, in Los Cerritos, presumably for the purpose of exploring the deeper formations north of the former street, by slant drilling, as that street limits the area in which derricks may be erected in that vicinity.

Rumor has it that other attempts will be made farther southeast, although Shell Oil Company's unsuccessful venture just east of Cherry Avenue, 10.368 ft deep, may prove a deterrent. This well was at the northern margin of the developed area. The eastern end of the field has already had considerable deep prospecting, as discussed before.

In Bulletin 118 of the State Division of Mines, Wissler classifies the De Soto zone as being in Division D of the Puente formation, which is of Upper Miocene age. This places it in the "Luisian stage" of Kleinpell. He shows this zone as being roughly equivalent to the Ford zone at Wilmington and to the producing zone (1940) at Seal Beach. While the zone discussed in the present article may not be of exactly the same age as the original "De Soto" zone farther to the southeast, correlations indicate that there is not much difference. The top is clearly marked on the electric logs of the new wells, and the zone seems to be quite uniform in character, as shown by the example of Jerman's discovery well, Victory 1, a segment of whose electric log is shown herewith. So far as known, the holes shown on the accompanying map are about vertical. ***

Why Call it a Derrick?

That word you use so often —Derrick—had an origin far removed from the oil country. It is traced to the seventeenth century. A hangman of Tyburn, near London, was named Derrick. Derrick built a gallows which was dubbed "the three-legged mare" and "Tyburn tree." Thereafter, such structures came to be known as "Derricks."

—B-A Newsvent T.P.L.

Petroleum Exploration in Brazil*

EARLE F. TAYLOR†

BRAZIL is the largest country in South America with an area of 3,286,170 sq miles, which is about 200,000 sq miles greater than the area of the United States. From north to south it extends from about 3 deg North latitude to about 33 deg South latitude, and from east to west from 35 deg to about 74 deg west longitude. The Equator crosses northern Brazil at the mouth of the Amazon River, just north of the city of Belem. The Tropic of Capricorn crosses the city of Sao Paulo in southern Brazil. Brazil adjoins all countries in South America with the exception of Chile and Ecuador. Brazil's present population is about 41,000,000.

Regional Geology

Although much of Brazil consists of large igneous and metamorphic provinces there are also large sedimentary basins. Of the latter, the 10 areas shown in Fig. 1 have been selected as possible petroliferous areas and will be discussed briefly in turn.

1. *Parana Basin.* This extensive sedimentary basin includes most of the states of Rio Grande do Sul, Santa Catarina, Parana, and Sao Paulo, as well as parts of Minas Gerais, Goias, and Mato Grosso. Approximately 318,000 sq miles of this basin are in Brazil, however, the basin is not confined to Brazil, but extends southward into Uruguay and westward into Argentina and Paraguay.

Sediments in the Parana Basin range in age from Devonian through Upper Cretaceous. The rocks of primary interest so far as petroleum is concerned, range from Devonian to Triassic age. These rocks are estimated to be 4000 to 6000 ft thick. The upper part of the section contains basalt flows, a part of the Serra Geral volcanic series that blanket most of the central part of the Parana Basin. Volcanic rocks are estimated to be from 1600 to 2500 ft thick and are probably Upper Triassic or Jurassic.

Structurally, this appears to be a large sedimentary basin bordered by igneous and metamorphic rocks. Dips measured in the sedimentary section along the eastern border of the basin are low—of the order of one degree. Numerous dikes and sills have intruded the sediments causing local steepening of dip and complicating local structure. Regionally, there is a low west to southwest dip into the basin. A few small, local structures have been described, but since the exploratory work is just now getting underway in this region, no significant data are available concerning structural trends.

There is no petroleum production from the Parana Basin at present but oil and gas shows have been reported from many shallow tests drilled for coal, oil, water, and other minerals. In most cases, the oil and gas test wells were drilled with little or no structural information. The sedimentary section in the Parana Basin contains several marine fossil horizons in shale beds, much carbonaceous material, and bitumen deposits have been observed on the surface. The stratigraphy and structure have yet to be worked out in detail; therefore no drilling sites have been selected.

2. *Alto Araguaia Syncline.* This is an area of approximately 40,000 sq miles. It is, in part, probably a northward extension of the Parana Basin. Devonian rocks outcrop on the north, east and west sides of the synclinal area and Cretaceous and Tertiary sediments cover the center. The stratigraphic section for the Alto Araguaia Syncline mainly includes sediments ranging in age from Devonian through Upper Cretaceous, the Tertiary rocks occuring as remnants only. No surface evidences of petroleum have been recorded in this area and, so far as known, no test wells for oil and gas have been drilled.

3. *Eastern Coastal Plain.* This is a small coastal belt of about 9900 sq miles. Very little is known concerning the structure or stratigraphy. Exposed sediments are Tertiary and marine Quaternary. The regional dip is thought to be to the east.

4. *Bahia Graben.* The Bahia Graben, where all Brazilian drilling operations are now concentrated, has an area of about 14,460 sq miles. It is partially divided into two smaller basins by a sub-surface ridge of metamorphic rocks. The southernmost basin is called the Reconcavo and contains all Brazilian petroleum production to date. This area will be described in some detail below.

The Bahia Graben has a sedimentary section that approaches 15,000 ft in thickness. Oil is produced from the middle of this section from beds of probable Lower Cretaceous age that have a total thickness of 6000 to 8000 ft. The Cretaceous rocks are underlain by red beds of unknown age and overlain by a clastic series believed to be of Tertiary age. For the most part, the Cretaceous sediments are lenticular, fine-grained clastics of brackish water deposition.

Structurally the Reconcavo area appears to be a graben and the Northern Bahia basin is probably this type of structure. The fault zone is well developed on the east side of the basin, especially near the city of Salvador. Surface and sub-surface dips are high and there has been some small scale faulting of the sediments. There appears to be well-developed folding of the sediments to give north-south trends along which accumulations of petroleum occur.

Although surface indications of petroleum are not common in the Bahia Graben, a small number of seeps of oil have been described. Also, oil droplets and staining have been observed on the surface in shales and sand lenses.

5. *Northeastern Coastal Plain.* This is a long, narrow province which forms a coastal belt in the states of Sergipe, Alagoas, Pernambuco, Paraiba, Rio Grande do Norte, and Ceara.

It has a total area of approximately 17,792 sq miles. Much of this sedimentary region is relatively unknown in detail. Some work has been done at the southern extremity in the States of Sergipe and Alagoas. Six wells have been drilled in Sergipe, primarily to locate salt deposits, and others in Alagoas, near Maceio.

The sedimentary section, as it is known today, is similar to that in Bahia. However, there are notable differences, too. A thin stratigraphic

*Published with permission of General Joao Carlos Barreto, President of the Conselho Nacional do Petroleo, Rio de Janeiro, Brazil.

†Geologist, DeGolyer and MacNaughton, Dallas, Texas.

EXCLUSIVE

FIG. 1

sequence, believed to be Triassic, is exposed along the Sao Francisco River. This consists of highly fossiliferous limestones with interbedded shales and sandstones. It underlies a section of Cretaceous sandstones and shales, with interbedded fossiliferous limestones, estimated to be 3000 to 4000 ft thick. Overlying this is a limestone series about 2500 ft thick believed to be Cretaceous. Several hundred feet of coarse sand and gravel of Tertiary age overlie the Cretaceous sediments. The total thickness, therefore, is of the order of 6000 to 7000 ft.

The regional dip in the Northeast Coastal Plain is to the east. Some dip reversals have been noted and several faults have been described, especially near the sedimentary-basement contact. Dips of the sediments, in observed exposures, average 5 to 20 deg.

Few surface indications of petroleum have been described in this region. However, several of the salt tests drilled in Sergipe have had oil and gas shows in them. As yet nothing of commercial size has been developed.

6. *Maranhao-Piaui Basin.* The Maranhao-Piaui Basin, third largest sedimentary basin in Brazil, has an area of approximately 235,520 sq miles. Unlike the sedimentary provinces adjacent to it on the east and southeast, this basin has a thick Paleozoic section of Carboniferous and Permian age which appears to hold the major possibilities for petroleum.

The total thickness of sedimentary formations studied to date is about 5200 ft. Of this total, about 3800 ft are Paleozoic and the remaining 1400 ft are Cretaceous and post-Cretaceous. The sediments are primarily sandstones, siltstones, and shales with some cherts, dolomite, gypsum and salt. Fossils have been collected from all principal formations in this basin and are especially plentiful in the Permian. Recent studies in this basin indicate a thickening of the section from east to west into the basin. The section also becomes less sandy to the west. Paleozoic sediments are of shallow water marine origin while much of the Mesozoic and all of the Tertiary appear to be non-marine.

The regional dip of sedimentary formations is low. It is slightly steeper in the Paleozoic formations than in the Cretaceous but in both cases it is less than one degree. Some small faulting has been observed but nothing of great significance. One or two major reversals of dip have been described in reconnaissance reports but

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A geological inspection party in Bahia included: Two Brazilian chauffeurs, Jack Dunlap (dark glasses), DeGolyer and MacNaughton; Dr. Gerson, Conselho geologist; Wilbur Sherman, DeGolyer and MacNaughton, representative in Rio De Janeiro; Louis Dixon, Conselho geologist; J. E. Brantly, Jr., resident geologist with Drilling and Exploration Company.

details are not yet available. In about 30 localities volcanic diabase eruptives have been mapped. Most are about one mile in diameter and intrude Permo-Carboniferous strata. These strata show only slight metamorphism, however.

No seepages or asphalt deposits have been described in the Piaui-Maranhao Basin. Oil shales have been described, however, and several organic shales suitable as source beds of petroleum were noted in recent surveys.

7. *Amazon Delta.* Relatively little is known of the geology of the Amazon Delta since almost the entire region is covered by recent deposits. The area believed to be underlain by sediments is approximately 37,760 sq miles. In the center is a large land mass called Ilha de Marajo. Data derived from geophysical surveys on this island indicate a sedimentary series at least 10,000 ft thick under the island. On the basis of outcrops in adjoining sedimentary provinces it is believed that a thick Paleozoic section is probably present.

8. *Lower Amazon Basin.* Lying between the Amazon Delta and the vast Upper Amazon Basin is a region which we have called "Lower Amazon Basin." This comprises an area of 94,720 sq miles, occupied in part by the valley of the Amazon River. At the western border of this sedimentary province lies the city of Manaus, a large inland trading center which is visited daily by many river steamers as well as scheduled airline flights.

The sediments known to be present in the Lower Amazon Basin range in age from Cambrian through Tertiary. The Cambrian sediments are metamorphosed and lie with discordance on the basement complex. Overlying the Cambrian are low-dipping sandstones and shales of Silurian age. These are known in outcrops north of the river only. The Devonian sandstones and shales, however, are exposed both north and south of the Amazon River. The Devonian has been penetrated in cable tool wells for an average thickness of 886 ft. The Devonian is overlain by Carboniferous rocks consisting mainly of fossiliferous limestones with interbedded sandstones and shales. This section was assigned a thickness of 807 ft in one well. Overlying the Carboniferous, at least near the borders of this basin where studies have been made, are sediments of Tertiary age. Tertiary rocks are, by far, the most widespread of all age groups on the surface and consist of bright colored, fine-grained sandstones, shales and clays. The total thickness of sediments in the Lower Amazon Basin is not known. Wells near the borders of the basin, however, have drilled through more than 2000 ft of sediments without reaching basement.

Regionally, the structure is that of a trough. The rocks on the north side dip south and those on the south dip north. There is some evidence of a high buried ridge between the Lower Amazon Basin and the Amazon Delta. Of the wells drilled in this province, several have encountered oil or gas shows in what is believed to be Devonian limestone.

9. *Upper Amazon Basin.* This largest of sedimentary basins in Brazil has an area of 366,080 sq miles. Since the surface of this basin is almost entirely covered by Tertiary and Quaternary deposits, it is impossible, at this time, to estimate accurately the size of the Paleozoic basin and the extent of overlap of the Tertiary onto the basement. In the Lower Amazon Basin the width of outcrop of the Paleozoic sediments is increasing westward so it is possible that extensive Paleozoic deposits occur below the Tertiary in the Upper Amazon Basin. Also, in the Territory of Acre to the southwest, questionable Devonian and a well-developed Cretaceous section have been described. Thus it is possible that a thick, well-developed sedimentary series containing rocks ranging in age from Cambrian through Mesozoic and Tertiary exists in the Upper Amazon.

10. *Acre Andean Area.* Some exploratory work has been done in years past by the Brazilian government in the Territory of Acre, since petroliferous sediments had been described in adjoining regions of Peru and Bolivia. The Acre Andean Area, which includes 53,120 sq miles, is covered mainly by Tertiary sediments, but a narrow belt of Cretaceous sediments outcrops along the southwestern border. Surface studies in this place indicate a Cretaceous section of about 4400 ft probably underlain by Devonian. Several shallow cable tool wells have been drilled here yielding some stratigraphic data. The section includes sandstone, shale and limestone, and much of the shale is apparently quite calcareous.

The sediments in the Acre Area are folded and faulted. The faulting appears to be normal and some displacements may be of the order of hundreds of feet.

Brief Summary

In summarizing rapidly the above data for the "ten possible petroliferous areas" of Brazil we find that of a total Brazilian land area of 3,286,170 sq miles, approximately 1,187,136 sq miles, or 36 per cent, is sedimentary rock in basins sufficiently large to be interesting from an exploratory viewpoint. The average thickness of sediments, where such information is available, is about 7200 ft.

Petroleum Development

The following is a brief history of petroleum development in Brazil and a description of the geology of existing fields, all of which are located in

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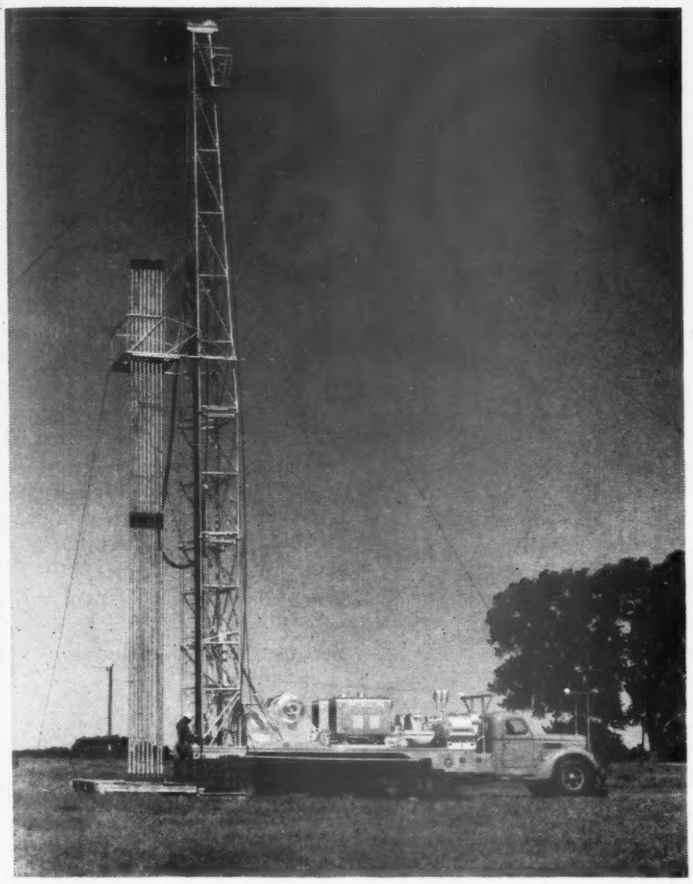

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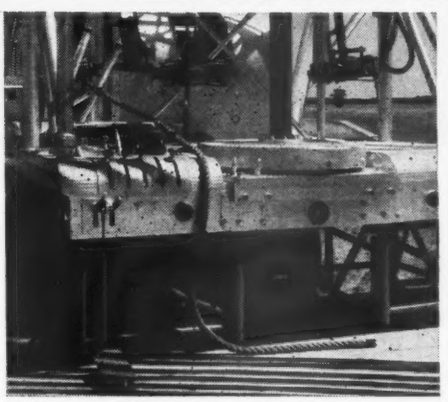

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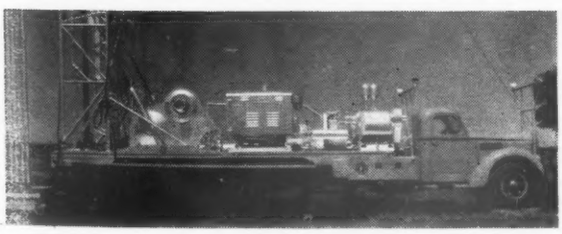
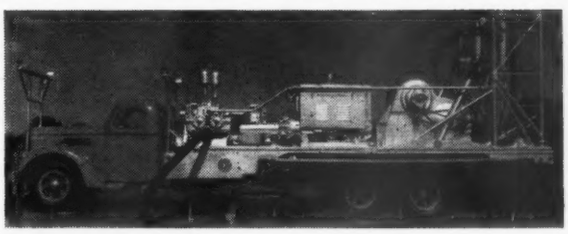


The right hand view of the 2500 Holemaster Drill shows how even distribution of weight has been achieved, through superior engineering, without disturbing the accessibility of the different units. Adjustments can be made on all parts of the rig with minimum effort.



This left hand view of the FAILING 2500 Holemaster Drill shows the patented substructure in working position. The special platform makes all working parts more easily accessible to the drilling crew. It also saves time in day-to-day, routine operations.

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the Reconcavo area of the Bahia Graben. (Fig. 2.)

The first well to produce oil in commercial quantities in Brazil was drilled in January 1939 by the National Department of Mineral Production. It was their well No. 163. The "Conselho Nacional do Petroleo," or National Petroleum Council, had been created by Decree Law in April 1938 but did not assume responsibility for petroleum exploration activities until June 1939. Today the Conselho is directing all phases of the petroleum development and exploration program in Brazil, from its main offices in Rio. President of the Conselho is General Joao Carlos Barreto; vice president and head of the Technical Division is Dr. Avelino Ignacio de Oliveira.

A large staff and much of the drilling equipment owned by the Conselho is located in Salvador, Bahia, the center of most of the drilling exploration program at the present time. Dr. Pedro de Moura is in charge of the work in this region. Six fields have been discovered in the Reconcavo of Bahia since 1938. However, the Aratu field is primarily a gas reserve and the Pitanga field, with but one small well to date, has little commercial significance. The remaining four are Lobato-Joanes, Itaparica, Candeias, and Dom Joao. The general structure, stratigraphy, sand conditions, and production problems of these four fields will be discussed briefly.

Lobato-Joanes Field

The Lobato-Joanes field, site of the first productive well in Brazil, is located within 1200 ft of the eastern fault scarp of the Bahia Graben. Production occurs in a belt about 800 ft wide and parallel to the fault scarp. The sand is about 60 to 75 ft thick and lies against basement rocks of the fault scarp, which dips westward about 43 deg. No drilling has been done in this field since 1944 at which time there were 4 producible wells. In all, 18 wells were drilled here.

Without exception, all wells drilled in the Lobato-Joanes field are of small productive capacity and all are pumpers. Production problems result chiefly from the high paraffin content of the oil which deposits on the inside of tubing strings, in the flow lines, and in the lease tanks. Wells must be pulled and the tubing cleaned on an average of once a month for most efficient operations. Tanks require steaming to warm the oil before it is transferred and flow lines must be cleaned at regular intervals.

The oil is black in color and has a gravity of about 32 API. The oil has a high pour point due to the paraffin content, which is probably 20 per cent. On the surface this oil will gel at a temperature of 75 to 80 F.

Itaparica Field

This field is located on the northwestern tip of the Island of Itaparica in Todos os Santos Bay west of Salvador. (Fig. 2.) The discovery well was completed September 1942 as a dual producer of oil from a lower sand, and gas from an upper sand. All production is above 4000 ft from sands on a small anticlinal structure. Average daily oil production is 50 to 75 bbl per well. In 1946 a deep test was completed to the basement at about 6400 ft. No shows of oil or gas were encountered in the "Brotas Red-bed section," as it is called, below the producing zones. There is no drilling activity in this field at the present time.

Production problems in the Itaparica field are similar to those at Lobato-Joanes and include paraffin deposition in tubing, flow lines, and tanks. As this field is located on an island, the oil must be transported by sea to the nearest refinery.

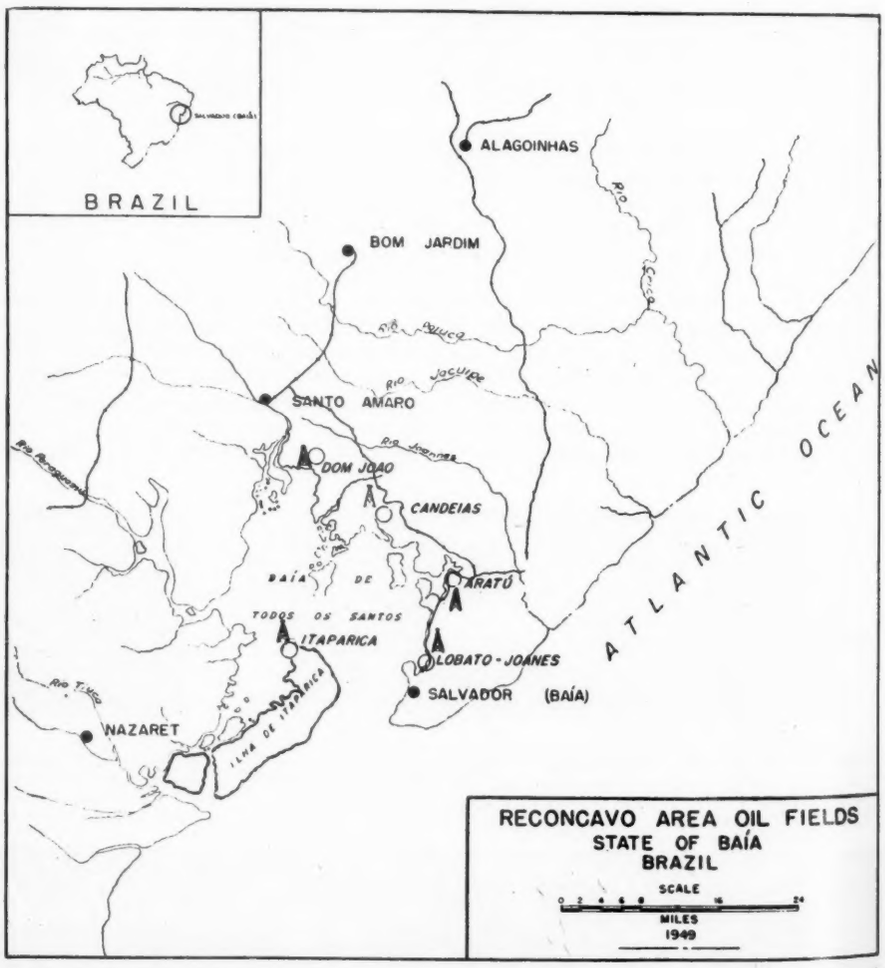
The oil at Itaparica is black in color and about 30 API in gravity. It gels at about 70 F due to the high paraffin content.

Candeias Field

This is presently the largest producing field in Brazil with about 50 productive wells. It was discovered in 1941 on a 6000-ft test plugged back to 3900 ft. Drilling is continuing at the present time in Candeias. The production is found in fine-grained, lenticular sands, between 2000 and 4000 ft from the surface. The largest well to date—C-26—had an initial production of more than 2000 bbl a day. Structurally Candeias is a sharp asymmetrical anticlinal fold with a steeper east flank. The shale section, in which the productive sands occur is slickensided and contorted, and faulting is indicated. A deep test encountered the top of the red-bed section at about 5500 ft. This section, as noted above, was unproductive on Itaparica and is about 4200 ft thick. This gives a basement depth of about 9700 ft at Candeias, but the lower 4000 ft of sedimentary section is probably unproductive.

Because of the high paraffin content

FIG. 2



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of the Candeias oil, production problems are many. The oil has a gravity of about 28 API and it is in a semi-solid state when pumped from the wells. It piles up in production tanks to the extent that it is necessary to wait several hours after a tank is filled before an accurate gauge can be taken. These conditions necessitate special heating equipment for the flow lines and storage tanks, as well as frequent pulling of the wells.

Dom Joao

The Dom Joao field, the most recent discovery in Brazil, was brought in early in 1947. To date there are 12 producing wells and one dry hole, in this field. It is located nearest the western border of the Bahia Graben where sand conditions in the Reconcavo appear to be best. Production is found in several sands between 800 and 1100 ft. Although the producing sands in Dom Joao are of approximately the same age as those in Candeias and Itaparica, they appear to be thicker and more consistent. As in the case of Candeias, this field appears on the surface as a shale lowland surrounded by sandstone rim hills. Drilling operations are continuing here at the present time.

Although production data are mostly lacking in the Dom Joao field, it appears at this time that the oil has less paraffin than in other producing Brazilian fields. Sands appear to be more persistent with porosities ranging from 20 to 25 per cent and oil saturations of the order of 60 to 70 per cent. For example, Zone C, which is typical, has a sand thickness of 26 ft, an average porosity of about 22 per cent, and an oil saturation of 65 per cent. Seven oil zones have been penetrated in the field and more than one zone usually produces in each well.

Production performances for Brazilian fields are mostly lacking since none of the wells have been continuously produced for any length of time. This results from a lack of refining capacity in this region. Construction of a refinery is now in progress in the Reconcavo, and it is expected that refining operations will commence here during 1950. It is probable that total productive capacity of all fields at this time is of the order of 5000 bbl daily. New wells are being completed each month, however, and this figure will increase substantially.

FIG. 3

GENERALIZED COLUMNAR SECTION FOR THE RECONCAVO BAHIA
1947

AGE	FORMATION DESIGNATION	COLUMNAR SECTION	APPROXIMATE THICKNESS IN FEET	CHARACTER
TERTIARY	CAMASSARI		150	FLAT-LYING "IRONSTONE" CONGL; COARSE SANDSTONE
TERTIARY ?	SAO SEBASTIAO		850	SOFT, LOW-DIPPING, RED, WHITE, YELLOW, SANDSTONES SHALES AND CLAYS
CRETACEOUS	ISLAND		2550 3400	GRAY, MICACEOUS, CARBONACEOUS, FINE TO MEDIUM GRAINED, THIN BEDDED TO MASSIVE SANDSTONE, THIN BEDDED, GRAY AND BROWN, MICACEOUS SILTSTONE GRAY AND GREENISH-GRAY, MICACEOUS, SILTY SHALES. OSTRACODA
CRETACEOUS	SANTO AMARO		1600 3500	SHALE, GREEN, GRAY AND BLACK, CALCAREOUS, BANDED FRACTURED, SLICKENSIDED; OSTRACODA, LEPIDOTUS, ESTHERIA; SILTSTONES. GRAY, BLACK, MICACEOUS, BRANDED. SANDSTONES, MEDIUM GRAINED, GRAY, MICEACEOUS
?	SERGI SS. BROTAS		2600 4300	SANDSTONE, RED, WHITE, VARIEGATED, COARSE GRAINED CONGLOMERATIC, ARKOSIC, CROSS-BEDDED, SANDSTONE AND SILTSTONE RED, AND GRAY, CROSS-BEDDED; SHALE, RED AND GRAY, MICACEOUS, SANDY, WELL INDURATED. HARD BASAL CONGLOMERATE
UNCONFORMITY				
BASEMENT	COMPLEX			

CONGLOMERATE
SANDSTONE
SILTSTONE
SHALE
CLAY

Probable Future for Brazil

At this time the trend in Brazil is toward an accelerated and expanded exploration and development program by the Brazilian government. This work will be under the direction of the National Petroleum Council. However, North American geologists are at present assigned to some surface exploration parties. The drilling program is under the supervision of North American technicians. The geophysical program under way at this time is being conducted by North American companies using both Brazilian and American technicians. An expansion of this program is likely.

Under provisions of the new Brazilian Constitution, a new Petroleum Law has been written by a commission appointed to formulate the conditions under which foreign companies can participate in development of Brazilian petroleum resources. The law has been presented to the Congress where it is now in debate. Until the recommendations of the Commission have been acted upon by the Congress and have become law, the nature and extent of foreign participation in future development of Brazilian petroleum resources will not be known.

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* * *

Structure and Chemical Control of Drilling Muds

A. W. McCRAY*

ONE of the best ways there is of understanding anything is to understand its origin and how it was made. This is true regarding the structure of a drilling mud. When a sack of prepared and finely ground bentonite is mixed with water, there results a homogeneous appearing fluid that is much akin to the familiar mud of boyhood. This familiar appearance should not be allowed to let us forget that the mud was made by mixing a finely ground solid powder into the water. It is true that the finely ground particles subdivide further as they mix into the water. As much as two or three days of aging in the water, particularly when combined with pumping, improves the mud as the particles reach their ultimate degree of subdivision. The particles never dissolve in the water, however; they remain small solid particles or crystals of clay minerals.

The clay divides into such small crystals that the individual particles cannot be seen even under the most powerful microscopes (those microscopes using light). If a beam of light is passed through a very dilute mud suspension held under a powerful microscope, however, the reflections of the light from the crystal faces can be seen as the particles are bombarded to and fro by the thermal vibrations of the water molecules. This is the familiar Brownion movement that may be observed on individual droplets of oil when an oil-water emulsion is placed under a powerful microscope. The extremely small size of the clay crystals makes forces become relatively important to them, forces that have no effect on larger-sized particles. Gravitational attractions for each other and the small electrical charges carried by them cause the particles of clay to effectively support one another, as well as finely ground weighting material, even though they are separated from each other and dispersed in the water.

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The great mathematician Einstein once derived a formula for the viscosity of a suspension of solid spheres in a liquid. This equation is accurate enough to be used for calculating the diameters of large molecules carried in a liquid of much smaller molecules. In his derivation of the equation, he postulated that there must be no interference between the solid particles. Now this equation in no way describes the viscosity of a drilling mud system, except probably very dilute suspensions of clays, because there is a considerable amount of interference between the clay particles. There is a rapid increase in the viscosity of a drilling mud as comparatively small fractions of clay are added.

Forces Between Clay Particles

The interference forces between clay particles are further evident in the ability of mud to turn into a gel when it is not flowing. When permitted by reason of the mud standing quietly, the forces attached to the clay particles orient the particles in such a way that the forces balance each other and effectively interlock the particles. A gel structure is built up, and one clay particle cannot move without also moving another clay particle. Normally, gel strength builds up rapidly at first; and then the build up is slower as the total number of particles remaining to be oriented becomes smaller and smaller. Start pumping the mud again, and the alignment of the clay crystals is disturbed and gradually broken down completely, and the gel returns to a fluid condition. This ability to change from a fluid to a gel and back to a fluid, by reason of its flow or quiescence, is referred to as the thixatropic property of mud.

It should be evident that if, by certain chemical treatments, the forces between the clay particles are changed and made smaller until they are weaker than the bombardment of water molecules, which always have thermal vibrations in accordance with the temperature, then the mud will not be able to develop any gel strength when allowed to stand. Nevertheless, gel strength, and viscosity properties as well, are evidence that forces do exist between clay particles. Also, those who have worked out the structure of bentonite, the way in which the atoms are arranged, find that the mineral develops as thin sheets or plates; that the individual crystals result from the mechanical breakage of the large thin sheets into small particles; and that, at the broken edges of those extremely small plates which are the clay particles, there exist unsatisfied atomic bonds that are responsible for electrical charges.

The nature of the forces between clay particles are the gravitational attraction exhibited by all objects for each other and electrical charges. These electrical charges are the same kind as may be obtained by running a rubber or plastic comb through someone's hair and then holding it near small pieces of paper. This is a familiar experiment in which the small pieces of paper jump up onto the comb or are repelled from it. These forces are presumed to exist principally at, or near, the broken edges of the clay particle. It has been calculated that an average-sized bentonite particle has around 500,000 of such individual electrical charges. The distribution of the charges and the way in which positive and negative charges are placed is obviously a determining factor in how the clay particles affect each other. Actually, this arrangement of charges is so complex that, as the particles are forced closer together, they attract each other at some distances of separation and repel each other at other distances. With this in mind, it can readily be understood that the number of pounds of clay in a barrel of mud can of itself greatly alter the properties of the mud.

Clay-Water Relationships

It is common knowledge that water is composed of the two gases, hydrogen and oxygen. The burning of hydrogen produces water vapor. It is also true that water has a natural tendency to separate, to a very slight extent, into two separate parts. The water molecule is composed of one atom of oxygen and two atoms of hydrogen. When the water dissociates it breaks up into a unit of one hydrogen particle and one particle containing one oxygen and one hydrogen. Now, both of these units carry electrical charges, and they are called ions. The hydrogen ion has one unit of positive electrical charge; the combined oxy-

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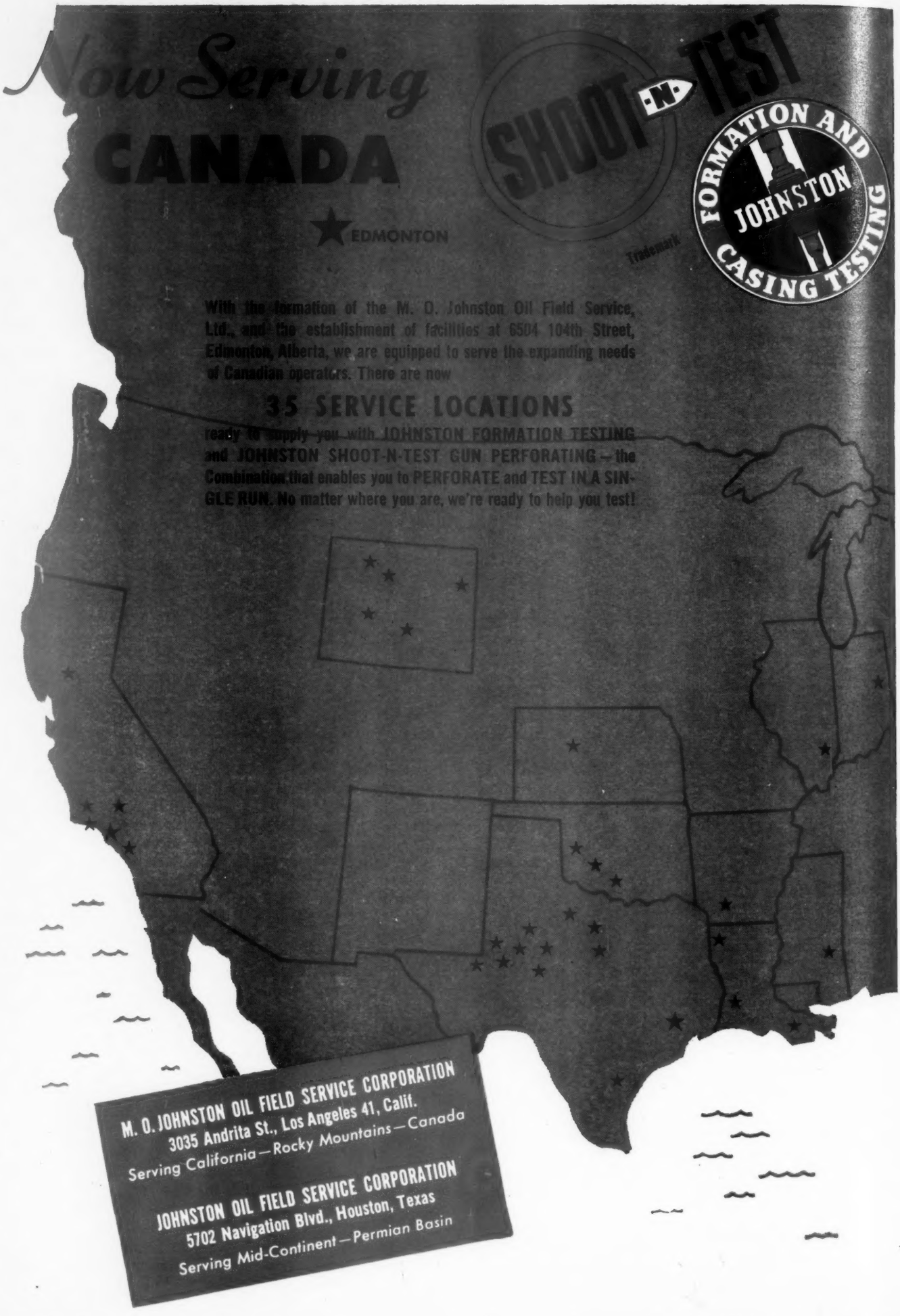
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gen and hydrogen, called the hydroxyl ion, has one unit of negative electrical charge. If clay is placed in water, and no other ions are present, then the ions furnished by the water itself are attracted to the edges of the clay particles where the structure of the clay has left unbalanced electrical charges that must be satisfied by substances outside of the clay particle.

While the clay particles dispersed in water will be satisfied entirely by the hydrogen and hydroxyl ions from water itself, if no other ions are present, this is not usually the case. Many substances dissociate into ions when they dissolve in water; and among these is common salt, which produces a positive sodium ion and a negative chloride ion. Clays found in nature usually have sodium associated with them, for it is a common soluble element. It is possible for some of the charges on the clay particle to be satisfied with hydrogen ions and others to be satisfied with sodium ions. Calcium ions, obtained from calcium chloride or from lime, may also satisfy either all or part of the inherent charges on the clay.

The positive charges on the clay particles are quite commonly satisfied by the negative hydroxyl ions. This condition is usually helped along by adding caustic soda to the mud. Caustic soda is sodium hydroxide, which supplies a large number of hydroxyl ions. A common negative ion that causes trouble, because it changes the distribution of electrical charges around the clay particle when it becomes attached to it, is the chloride ion. This trouble is known as salt contamination.

It is possible to trade the ions attached to a clay particle for other ions. Suppose that a sodium clay, one having sodium ions associated with it, is dispersed in water. Then suppose that some lime, yielding calcium ions, is added to the water. Originally, the sodium ions, associated with the clay, remain near the individual electrical charges of the clay particle, which they satisfy by reason of their having the opposite electrical charge. But the sodium ions can't remain stationary; they are jostled around continuously by the water molecules, which have a vibration corresponding to their temperature. The effect is probably much like a rubber ball dancing up and down from an elastic cord, with the sodium ion being the ball and the electrical attractive force represented by the elastic cord. Suppose again that, just as the sodium ion gets to its farthest position from the clay, a calcium ion comes floating in between. The sodium ion is automatically cut free, and the calcium replaces the sodium. This occurrence is known as base exchange. The common basic metals are sodium, calcium, potassium, and magnesium. They produce an alkali when reacted with water.

> It is believed that although the 32 largest oil companies have a four-to-one lead in reserves, it's two to one that the independent operator will find the new field and better than three to one that he will drill the exploratory well.

The ions replace each other on the clay particles according to rules of probability. If there are many sodium ions present in the solution, there will be a large proportion of sodium ions attached to the clay. If there are equal numbers of sodium and potassium ions floating around in the solution, there will be nearly as many sodium ions as potassium ions attached to the clay (the potassium ion is half again as heavy as the sodium ion and the numbers would probably not be equal). If calcium ions, which carry two electrical charges, are added to the mud, however, they become attached to the clay and remain at a closer distance to it than do the sodium or potassium ions. In addition, the calcium ions have two bonds onto the clay, where the others have only one. Consequently, they are harder to replace than the sodium or potassium, because there is less probability of other kinds of ions getting between them and the clay. For the number of calcium ions floating around free in the solution as compared to the other kinds of ions, there are proportionately more calcium ions attached to the clay than sodium or potassium. Under such conditions, the calcium is said to be preferentially adsorbed on the clay. Unfortunately, these equilibria that exist between the numbers of various kinds of ions floating free in the water and the number attached to the clay have not been reduced to mathematical relationships by experiments. Much remains to be accomplished in drilling mud study.

It may now be stated that the clay particle by itself is not the unit that, by being dispersed in water, makes up the drilling mud. It is the clay particle plus its atmosphere of surrounding ions that is the drilling mud unit. Change these ions and the unit is changed and the mud itself is changed and has different properties.

The Drilling Mud Unit

The clay particle plus its atmosphere of ions is technically known as a micelle. These must have definite electrical potentials in order that they repel each other sufficiently to keep from bumping into each other and forming aggregates or flocs that settle out of the water. Chemical treatments change these potentials by changing the kind and arrangements of ions around the clay. Suppose that salt is added continuously to a drilling mud. At first there is a building up of the number of ions from the salt around the individual clay particles; their potential increases. As more salt is added, the water between the clay particles also becomes filled up with the ions from the salt. When a sufficiently large number of these ions exist in the water between the clay particles, the effect of those ions originally surrounding the clay particle is nullified completely; and the potential of the particles and the micelle disappears. There is nothing to prevent the particles from joining together, and they floculate out and settle to the bottom. This is also the way in which clays are precipitated and deposited where a river of fresh water flows into the ocean and the clays pass from fresh into salt water.

Reasons for Chemical Treatment

The reasons for chemical treatment are easily explained in terms of the discussion already presented. It is known that clay subdivides into extremely small particles in water and that these particles carry electrical charges. Ions, which are charged particles in true solution in the water, are attracted to their opposite (positive or negative) charge on the clay crystal. This combination of clay crystal with its surrounding ions is the unit of the drilling mud system. All the charges and forces associated with the clay crystal, and their distribution, give the individual unit a potential that controls the characteristics of the drilling mud. The fundamental reason for adding chemicals to a drilling mud is to change the ions, and consequently potential, surrounding clay particles.

A reduction in viscosity can be accomplished by adding such a substance as quebracho. This effectively reduces the potential of the individual clay crystals, and they interfere less with each other while flowing. At the same time, the gel strength of the mud is lowered, for the same set of forces control both viscosity and gel strength. In this case, the water loss is also lowered. The water loss would seem to be a function of the closeness, or the manner, in which the clay crystals nestle together in the filter cake, where they are forced much nearer to each other than they are in the drilling mud itself. This forcing together is done, of course, in the filtration process,

where the clay crystals are stopped by the filter paper or the face of a sandstone in the hole, and the water part of the drilling mud goes on through.

Chemical treatments are for the purposes of modifying and controlling the forces between clay particles, to correct or prevent contaminations with undesirable chemical substances, or to add protective and auxiliary colloidal substances to the mud.

Principles of Chemical Treatment

There is a simple way in which to regard all chemical additions to the mud, both those added on purpose and those that enter the mud accidentally or inadvertently. All the chemical substances added into the mud may be regarded as contaminations. These contaminations obviously break down into two groups, harmful and beneficial.

Harmful contaminants commonly encountered are salt, anhydrite, gypsum. Almost any substance that gets into the mud in large amounts and dissolves, supplying a large quantity of ions, will fall into this group of harmful contaminants. The amount of a given material in the mud largely determines whether or not it is a harmful contaminant. For example, a low pH sodium-base mud can have without harmful effects, more carbonate or sulphate in it than chloride. The kind of mud also enters into this; a lime-base mud can stand more chloride than a sodium base mud.

Effect of Chemicals

Beneficial contaminants, as might be expected, include the common treating chemicals such as caustic, quebracho, the phosphates, and others. These either give the clay desirable properties by becoming attached to it, or they displace harmful contaminants formerly attached to the clay, or they affect the ions floating around in the water part of the drilling mud. Treating chemicals are often composed of large molecules that are adsorbed preferentially onto the clay. Sometimes the commoner chemicals are added in small quantity for the deliberate purpose of beneficial contamination. Small amounts of salt or bicarbonate of soda will increase the gel strength. The same mud materials may give a better mud system on one side of a field than they do in wells drilled on the other side of the field. Beside the possibility of a harmful contaminant occurring at one location, it is possible that a beneficial contamination occurs from the rocks drilled in another location.

The principles of chemical treatment of a drilling mud are:

1. Substitute favorable for unfavorable ions on the clay.
2. Reduce the effectiveness of a contaminant.
3. Dilute the contaminant.
4. Remove the contaminant from the solution.
5. Add an auxiliary colloidal substance unaffected by the contaminants.

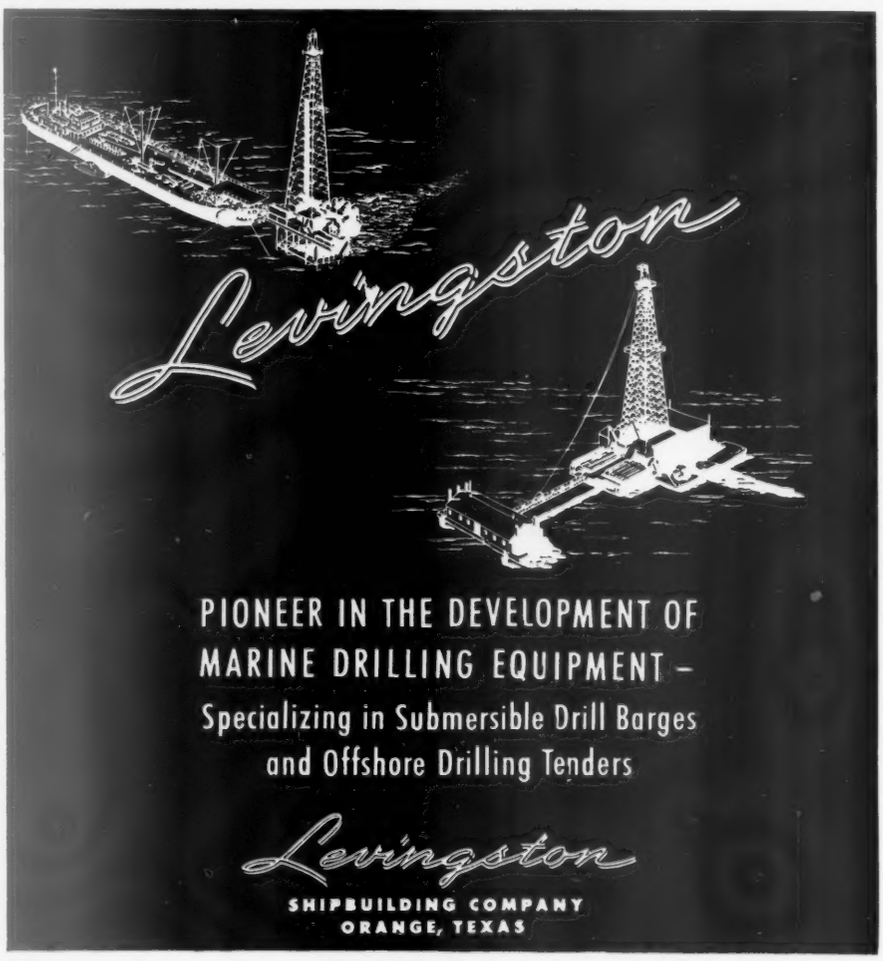
One of the best examples of the substitution of favorable for unfavorable ions is in the use of quebracho. The quebracho is attracted preferentially to the clay, and relatively small quantities are effective. A portion of the ions formerly attached to the clay are displaced; and more desirable qualities, such as lower viscosity, lower gel strength, and lower water loss, are obtained by the addition of the quebracho. When lime is added to a mud, the calcium ions displace the sodium ions formerly associated with the clay; and particles of lower potential strength that will give lower viscosities with higher clay content can be obtained by this substitution.

Effect of Caustic Soda

Reducing the effectiveness of a contaminant works somewhat on the same principle as a counter-irritant. The more different kinds of ions that there are in the water, the less chance there will be for the particularly undesirable ones to associate with the clay. There is more chance of their being crowded off-balance before they actually displace another ion from the clay. In general, the more ions there are in the water, the harder it is for any of them to leave and associate with other substances. The surrounding ions lower their efficiency, or their activity, in combining with other substances. The chemical generally used in serving this purpose is caustic soda. In lime base mud systems, a high caustic content is usually carried. This reduces the tendency of the calcium to interact with the clay; or, in effect, it makes the system less sensitive to small changes in the total amount of lime present in the mud.

Dilution of Mud

Dilution of a contaminant is about the only possible way of handling the highly soluble substances such as common salt, which are injurious to the mud. Other methods of treatment may be ineffective or too costly. Dilution by adding water (often with the addition of mud materials) may save discarding the whole system. On the other hand, this process sometimes works in reverse. Evaporation is essentially negative dilution. In West



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Texas, where drilling rates are slow and evaporation rates high, small amounts of contaminants in the make-up water become concentrated appreciably by the time a well is completed.

Removal of contaminants from solution in the water results also in their eventual removal from the clay itself, for the individual ions trade places repeatedly and continuously in association with the clay, as has been previously explained. Removal of the contaminants from solution can be accomplished by precipitation or by adsorption onto a protective, or buffering, colloidal substance. Calcium contamination can be removed by the addition of a soluble carbonate such as soda ash. Insoluble calcium carbonate is precipitated. Excessive carbonates can be removed similarly by the addition of lime; and, again, the insoluble calcium carbonate is formed and no longer affects the mud properties. It is probable that quebracho and starch absorb some of the chemicals present in the drilling mud when they are added to it. Sometimes the addition of fresh and uncontaminated bentonite accounts for the removal of a portion of the contaminants from the original clays present; but this is generally an ineffective and costly manner of mud treatment.

Auxiliary colloids are now used effectively for improving the water loss property of drilling muds. The viscosity and gelling effects of certain chemicals can be combatted by dilution or heavy chemical treatments or both. These treatments are at the expense of the water loss value, which is then reduced by the addition of an auxiliary colloid, such as starch or carboxymethyl cellulose, which is relatively unaffected by the contaminant. The use of organic colloids instead of clay for the primary colloid of the mud system has been prohibitively expensive in some cases.

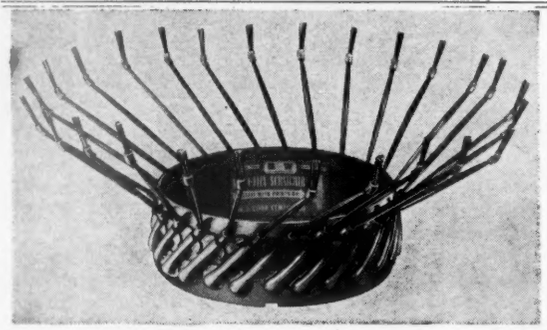
Pilot Tests

Pilot tests are a comparatively rapid and inexpensive means of determining the effectiveness of various chemicals on muds. When the mud properties are not what is desired, a small sample of the mud is taken and a small amount of chemical added in order to determine its effect. This practice can save the time and cost of adding hundreds of pounds of chemicals to the whole mud system, and it may avert failure to obtain the desired results. Chemicals can be added to the small sample of mud until the right combination gives the desired properties.

One chief advantage of pilot tests is often overlooked and neglected. When a mud system is slightly different from familiar systems, it is not sufficient to find out merely a combination of chemical treatment that will give the necessary properties. The effects of adding slightly more or slightly less chemical should be determined, in order to find out whether the mud system is operating on a flat plateau or whether, so far as amounts of chemicals are concerned, the system is on the edge of a precipice.

Pilot tests are not used as much as they should be. This is largely because they are time consuming. Awkward weighings of treating chemicals are performed at the test car. These weighings could be made easily beforehand under sheltered conditions, and the weighed amounts carried in small glass vials, so as to be readily available for field testing. Mixing is done in one piece of apparatus and testing in other pieces of apparatus. One single piece of apparatus should be designed for taking care of the mixing and the viscosity and gel strength tests. Nevertheless, pilot tests remain the most sound basis for drilling mud treatments.

It should be pointed out, however, that after the first few wells are drilled



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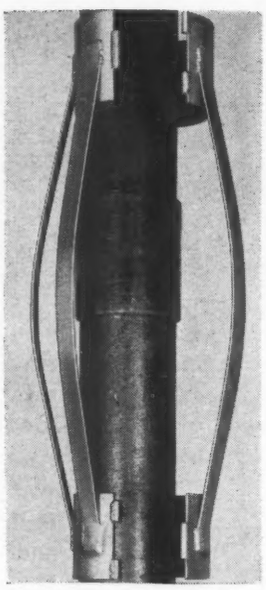

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in an area and the mud problems ironed out, there is little need for extensive pilot tests on subsequent wells. A slight overtreatment one day usually means less chemicals required the next day.

Calculating Mud Treatments

Much work has been done in physical chemistry in regard to equilibrium constants, solubility products, and the related laws governing chemicals in solution. One may be inclined to think that it should be possible to calculate a mud treatment. Two factors work against this. In the first place, all of the rocks occuring in nature have their own pecularities, often depending upon the locality. Some muds are composed entirely of native shales; and, in all wells, some of the rocks penetrated get into the mud system. These vary from place to place; no two wells ever drilled have been exactly alike, and no two mud systems have ever been exactly alike. In the second place, calculations of solubilities involve not only the constant, which depends on temperature, but they also involve activity coefficients of the various ions, which vary according to all the ions present.

These activity coefficients are the efficiency factors of the ions, which express their tendency, or rather their reluctance, to unite with other substances. They can be approximated, provided that all the substances in solution are known; but this is seldom the case. Texts on physical chemistry explain the manner of calculation of activity coefficients; generally speaking, the effect is more dependent upon the total number of ions present than it is upon the kinds of ions present. They are real values and have been measured in specific cases. A considerable amount of basic experimental work must be done, however, before reliable calculations can be made in extensive drilling mud treatments. In lieu of exact calculations, which may be possible sometime in the future after sufficient basic knowledge has been tabulated, the pilot test is available immediately for use on the mud system in the well.

Perhaps most mud treatments are centered on obtaining the proper viscosity in the mud. It is interesting to note related practices in other industries. The rubber, nitrocellulose, and ceramic industries measure viscosities, because they are a delicate measure for tracing slight chemical changes in such substances. In a drilling mud, where the degree of viscosity itself is the object of the treatment, direct measurement of the viscosity is the logical evaluation of the treatment.

The usual manner of running pilot tests is to use a 350 cu cm sample of the drilling mud, which makes one gram of chemical added to the pilot test equipment equal to one pound per barrel in the mud system. The smallest unit of treatment is usually one quarter of a pound of chemical per barrel of mud. The heaviest treatments usually are not more than four pounds of chemicals per barrel of mud.

Classification of Mud Systems

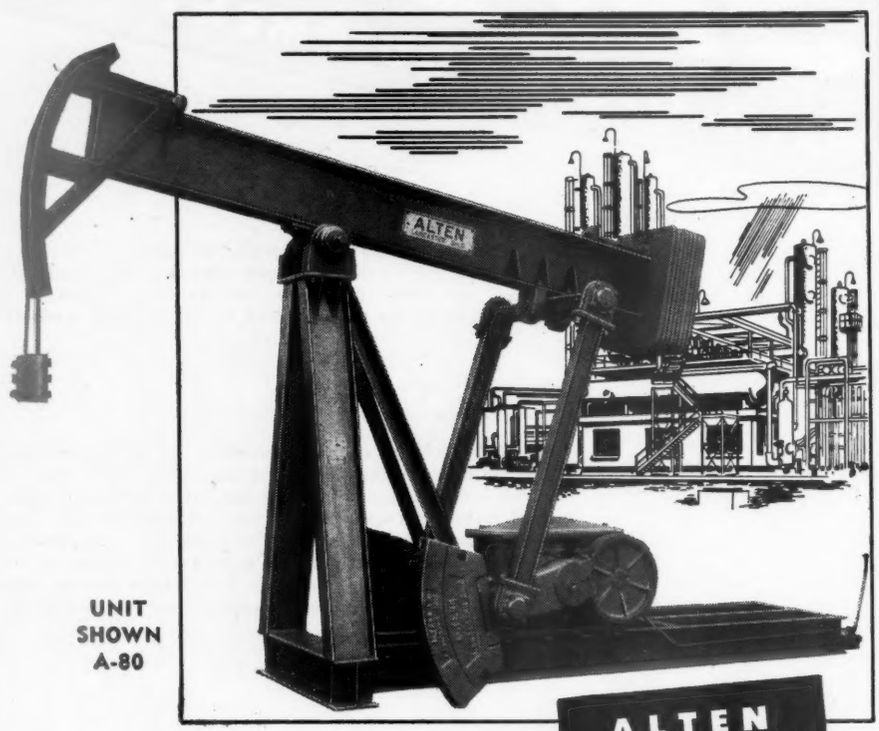
The primary classification of mud systems might be made according to the colloidal materials that form the base of the mud. These are sometimes used in combinations. The commonly used primary colloids are:

1. Bentonites and sub-bentonites (referred to as "gels").
2. Zeolites (the salt water colloid, "salt gel").

The commonly used auxiliary colloids are:

1. Starch (pregelatenized, for water loss control in presence of salts).
2. Carboxymethyl cellulose (a synthetic material for water loss control in cases of medium contaminations).

The bentonitic and native shale



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muds may be broken down further into systems according to the chemicals associated with the clays. Thus, there are the "phosphate muds," which are treated with phosphates. These bentontic muds are the "quebracho muds," which are treated with quebracho. The most concern here, however, is with the kinds of metallic ions that associate with the clay. They are:

1. *Sodium base.*

(a) Low pH (7 to 9). Hydrogen ions from the water can also associate with the clay.

(b) High pH (11 to 13). Sodium or similar ions associate primarily with the clay.

2. *Calcium base.* (a) High pH of 12 to 13 is used ordinarily. Alkalinity also should be high. Absorptive capacity of the clay is supplied largely by calcium from lime. Calcium is also present, however, in the water.

The unfortunate practice has developed of speaking of drilling muds as being on the "sodium side" or the "calcium side."On the "sodium side," additions of lime increase the viscosity; on the "calcium side," additions of lime decrease the viscosity. This language is picturesque enough when one is speaking specifically about the "calcium hump," which is the peak obtained in mud viscosity, and passed through by the first continuous additions of lime to a relatively uncontaminated and thick mud suspension. In such a mud system (where there are insufficient amounts of other chemicals present to interfere), further additions of lime cause a second increase in viscosity. The value of defining a mud system according to its viscosity reactions upon the addition of more lime is lost under such conditions. It is also lost where sufficient quantities of other chemicals are present to reduce the viscosity effects of the lime.

The question of deciding where the division is, between a sodium base and a calcium base mud, will probably be answered in the future by experimental investigations of the degree of dissociation of the attached ions from the clay crystals. Attached ions are free to dissociate, and thus increase particle potentials, unless driven to strict association by ions in solution in the water part of the mud. Perhaps it may be shown that when further additions of lime decrease the amount of this dissociation, then the mud is calcium base. Meanwhile, various definitions are offered, such as saying that a mud is lime base when further additions of lime do not affect the mud, or that it is lime base when on the "calcium side."

* * *

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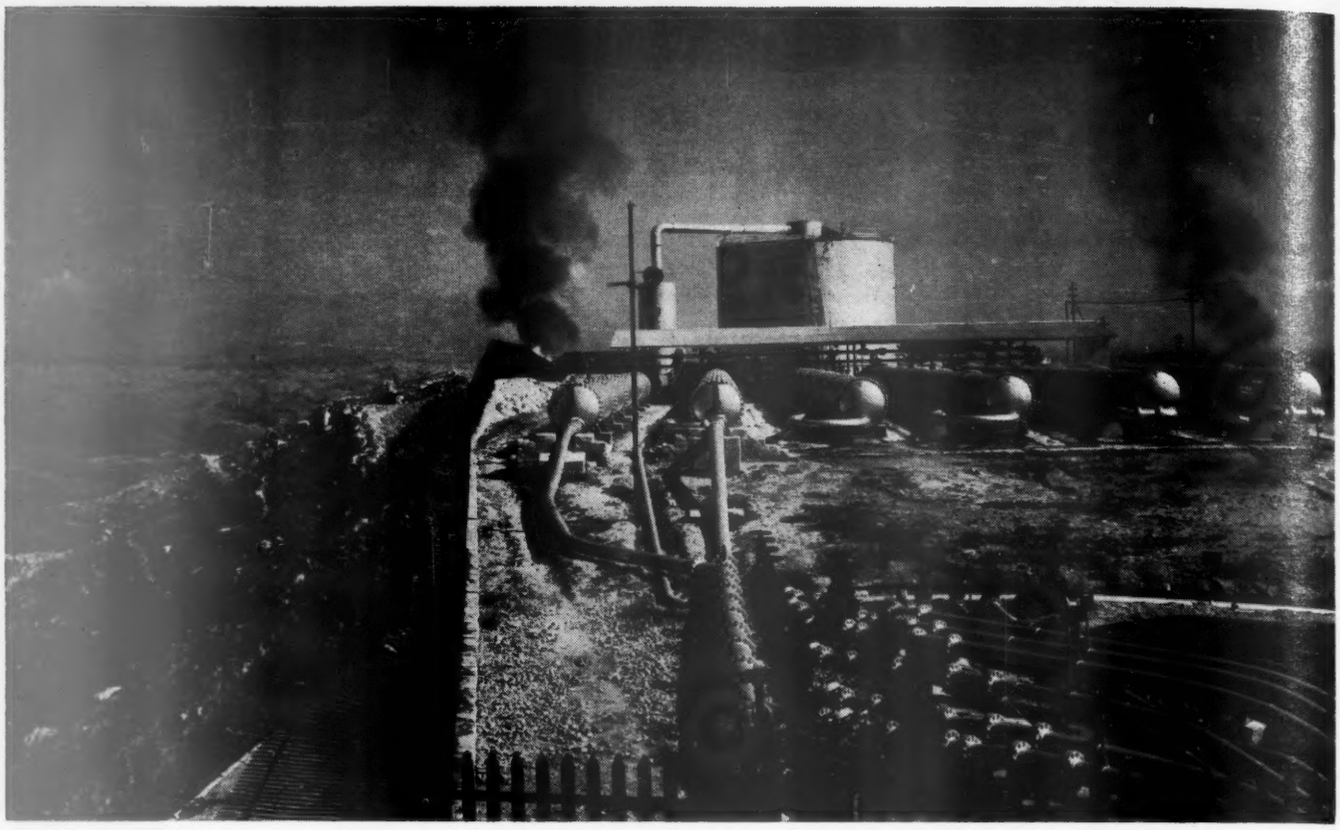

Photo courtesy Anglo-Iranian Oil Company.

Multi-stage stabilization unit at Haft Kel showing old type separators.

Production Systems in Iran

E. J. SOLE*

THE production systems on all but one of the producing fields in Iran in their main aspects follow the principle of multi-stage stabilization, differing only in the number of stages of stabilization, the arrangements of the units, and the details of the control gear. The stabilizer units, which are designed for each field, vary according to the well-head pressures and other factors, such as quality of crude required from the area and the topography of the field. The equipment on the newer fields embodies many improvements found necessary through experience in the working of the older units as well as many innovations. As a consequence the improved designs have been found to handle larger quantities of crude for the same weight of steel. Changes in operating details have also been instrumental in increasing throughput of newer units.

*Petroleum Engineer with the production department of Anglo-Iranian Oil Company, Ltd., at the head office in London.

Multi-Stage Stabilization

The system of producing crude oil in Iran known as multi-stage stabilization, in which gas is separated from the oil in a number of stages, was developed originally in the year 1930. With this process it is possible to retain in the crude a large percentage of casing-head gasoline (butanes and heavier) which would otherwise be carried over with the gas in a single stage separating unit. In the oldest field in Iran where the gasoline does leave the crude in the gas and is recovered in a gasoline absorption plant, it is blended with the crude and pumped to the refinery, this being the simplest and cheapest method of transporting the gasoline. Where multi-stage stabilization is adopted, the installation of large gasoline extraction plants is not necessary, as the gas from the higher pressure stages, representing about 75 per cent of the total gas evolved, is leaner than the tail gas from the majority of gasoline absorption plants.

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Type of Gas Separator

The horizontal type of separator has proved capable of handling large volumes of crude and is invariably adopted. The oil and gas enter at one end and the gas is taken off at the top of the vessel at about two thirds along its length from the inlet end. while the oil leaves at the other end of the vessel. If the vessel is kept approximately half full, a large surface of liquid is exposed and the gas and oil quickly reach equilibrium. In the

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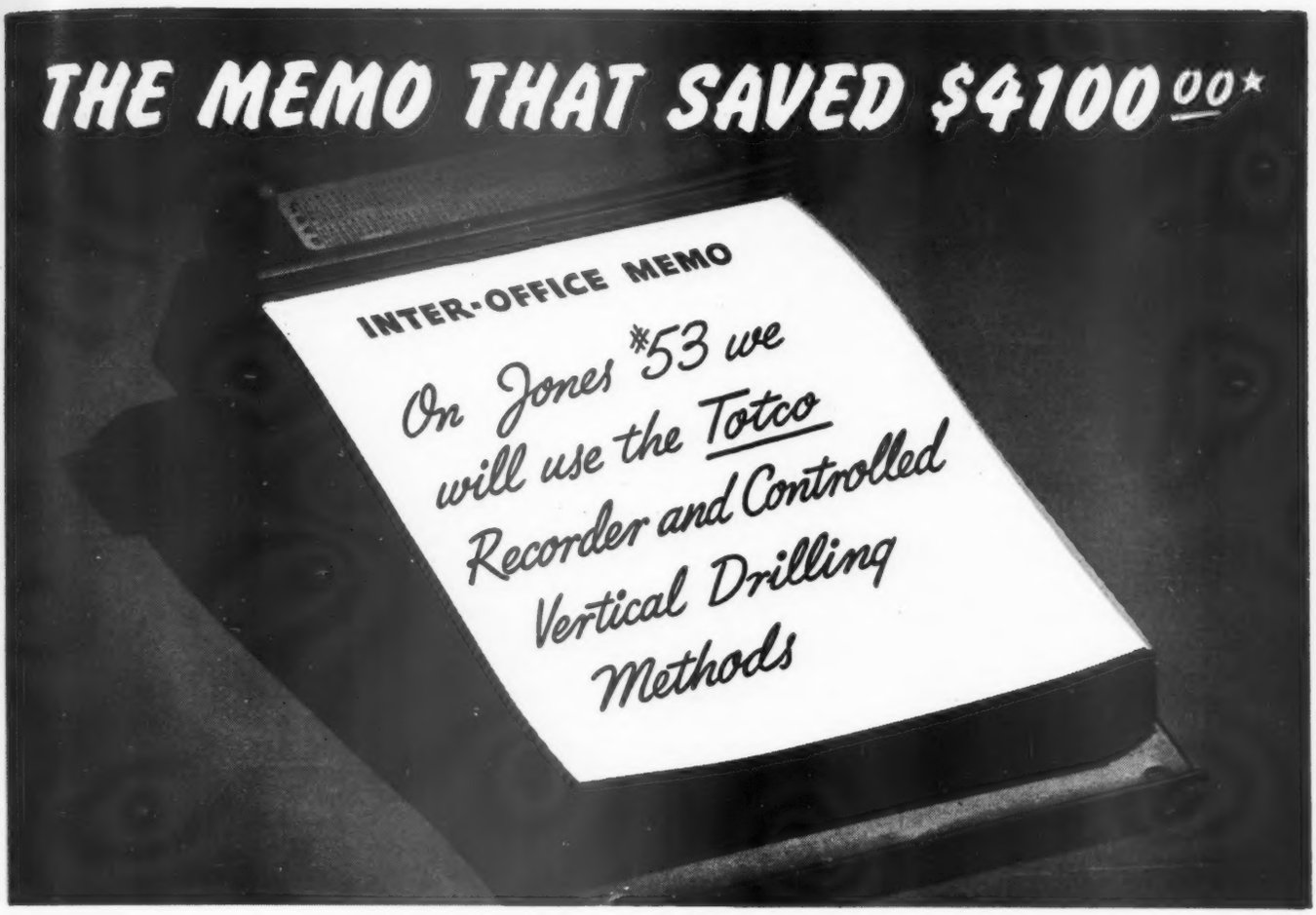

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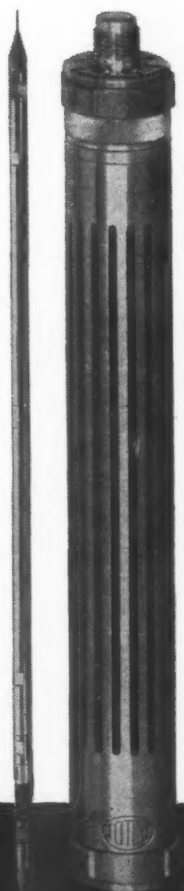

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normal operation of a multi-stage production unit in Iran, the volumes of gas and oil entering the separator are approximately equal at the separator pressure. This allows an efficient separation of gas and liquid to take place with a minimum of foaming, which will reduce the carry over of oil to a minimum.

In many other types of gas separation systems, where the crude suffers a considerable drop in pressure in the flow line before it reaches the separator, the gas/oil mixture is in the form of a mist consisting of small drops of oil dispersed in a large volume of gas, so that gas separators require to be fitted with baffles and other devices to knock out the drops of oil from the gas.

In the older types of horizontal separators there are no internal fittings but in the latest types both wellhead and stabilizer vessels are fitted with a tangential inlet, which is connected to the side of the separator vessel. Inside the vessel there is spiral inlet section extending about one quarter of the way down the length of the separator to give a swirl to the crude. The result of centrifugal action on the crude in the separator allows equilibrium to be reached in a much shorter time, thus increasing the throughput of the system. It has been found that the optimum time of separation is approximately 3 minutes. The spiral inlet section has a tube through the centre from which the gas evolved in the separator can pass to the gas outlet. These separators are inclined at an angle of about 1 in 30 to give a greater depth at the outlet end of the separator which will tend to prevent the coning or vortex action of the oil and the consequent passage of gas to the next stage. Well-head separators are usually 3 ft 0 in. in diameter by 60 ft long while stabilizer vessels are 4 ft 6 in. in diameter by 120 ft long. The relationship of the length to the diameter of the separator vessels is of the order of 30:1 maximum to give efficient separation.

Stages of Stabilization

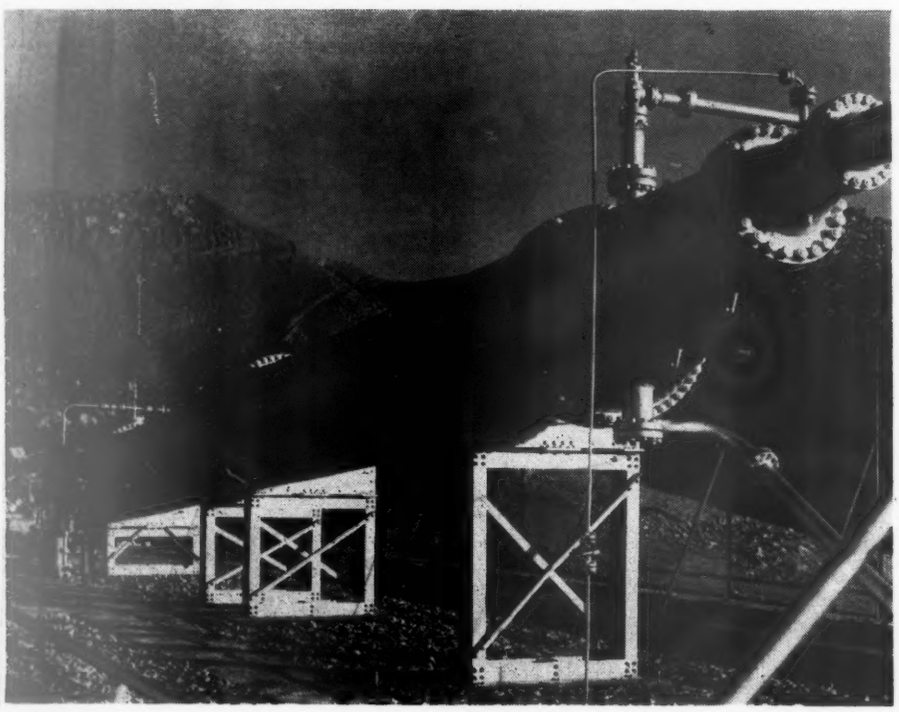
The number of stages of stabilization originally used in the pilot plant was six but in later stabilization units, the number has been increased to seven while even eight stages have been in use recently. The figure of six stages was originally determined from simple gas laws to give an efficient gasoline retention while the separator pressures were fixed so that approximately equal volumes of gas at separator pressures would be given off at each stage. In practice, however, it has been found that there are deviations from these gas laws at the higher pressures though these deviations hardly affect the workings of the multi-stage stabilization. Owing to the very large number of variables involved in calculating separator pressures to give the optimum results, it has been found quite satisfactory to determine these pressures by trial and error. The effect of temperature must also be taken into account in the operation of a stabilizing plant, as a rise in temperature will reduce the efficiency of the process by decreasing the solubility coefficients of the heavier fractions to a greater extent than those of the lighter fractions. As the oil pipe lines in Iran with a few exceptions are laid above ground, very large daily fluctuations of oil temperature occur as well as the seasonal variations. Oil temperatures may range from about 140 F in the summer to about 30 F in the winter. It has been found that 80 F is a good average temperature and has been accepted as the standard temperature in Iran. During the operation of a stabilization plant the day to day pressures are adjusted according to the actual femperature of the crude passing to give the necessary equivalent pressure at 80 F.

The initial pressures of the stabilization units, until recently were maintained as near as possible to the wellhead pressures, and in order to keep the first stage pressures as high as possible without interfering with the production of the wells, separators were installed at the well-heads. In the latest type of stabilizer unit, however, this practice was abandoned and the wells flow direct into the first stage separator at the production unit. Using this method, it was found that the production lines had to be increased in diameter.

The final pressures have been fixed to produce a crude at 10 psi at 80 F or atmospheric pressure. Sometimes a vacuum stage is also included in the installation. "Ten-pound crude," a standard product in Iran, is a crude that has been separated at 10 psi at 80 F, or at corresponding pressures to other temperatures of separation. This "pressure crude" enters the pump suction directly from the 10 psi separator vessel. Since there are no tanks in the pipeline system, and as the pressure in the pipeline never falls below 10 psi, the gas remains in solution until it reaches the refinery where the crude oil distillation benches receive it directly at this equivalent pressure.

When crude is required for export, which of course, means it must be loaded on to tankers, then the vacuum stage of the stabilizer unit may come into operation if the temperature of the crude is very low as in winter. The crude is stripped of all very volatile fractions mainly ethane and propane and can be delivered to the export terminal at a maximum vapour pressure specification, which prevents the danger of gassing in the storage tanks or in the tankers.

New type wellhead separator at Gach Saran.



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Multi-Stage Stabilization

The simplicity of the system upon which multi-stage stabilization operates calls for construction facilities which present no great difficulty. The installation can be made almost entirely automatic, pressures and liquid levels in the vessel being automatically controlled, while the regulation of pressure for changes of temperature can also be carried out by combined temperature-pressure controllers. As the maintenance required in multi-stage stabilization plants is very small, the operating efficiency is almost 100 per cent. The necessity for steam, water and other services that would be required for a gasoline absorption plant is eliminated. These factors all lead to low operating costs.

The efficiency of multi-stage stabilization is illustrated in the examples given in the following tables. Crude from one of the Iranian fields is examined to compare its yield when subjected to single-stage, two-stage, and seven-stage separation.

Table 1 shows the composition by weight in tons, of one million tons of bottom hole sample of crude.

TABLE 1. Composition of 1,000,000 tons of reservoir crude.

	Tons
Carbon dioxide	7,500
Methane	78,700
Ethane	20,200
Propane	25,300
Butanes	22,700
Pentanes and other hydrocarbons up to 150C	148,600
Hydrocarbons above 150C	697,000
	1,000,000

Table 2 shows the composition by weight in tons, of the crude recovered from 1,000,000 tons of reservoir crude when processed in (a) single-stage separation (b) two-stage separation (c) seven-stage separation systems.

The primary interest of an oil producer is to recover the maximum possible quantity of oil from the reservoir crude and to exclude as far as possible hydrocarbons which are gaseous at ordinary temperatures and, therefore, make for instability.

From Table 2 it will be seen that in processing one million tons of reservoir crude we obtain 57,470 tons more of stabilized crude from the seven-stage stabilization plant than from the single-stage plant, which is an increase of 7 per cent over the recovery in single-stage stabilization, and of 3 per cent over the recovery in two-stage stabilization.

As regards the quality of the crude, in which butane retention plays a large part, the recovery of butanes is 58.52 per cent for seven stage separation as compared with 9.56 per cent for single stage separation or 6.1 times as much. In the case of pentanes and other hydrocarbons up to 150 C the percentage recovery rises from 69.2 per cent to 95.8 per cent or an increase of 38 per cent over single stage separation. These recoveries, expressed in actual quantities, mean that from one million tons of crude we have a net gain of 11,120 tons of butanes and 39,090 tons of pentanes over the quantities recovered in single stage separation. This increased recovery of light fractions will have the effect of reducing the specific gravity of the final crude.

The gas evolved is seen to be 8.5 per cent less for seven-stage separation than for single stage.

"10-lb Crude"

Table 3 gives the recovery effected for crude separated off at the equivalent pressure of 10 psi and 80 F in seven stages. Comparing the results with those obtained for atmospheric crude separated off in one, two and seven stages the increased recovery from 10-lb seven-stage crude is apparent. Quantitatively, the crude recovered in 10-lb seven stage crude is 68,840 tons in excess of single-stage atmospheric crude, 36,870 tons more than two-stage atmospheric crude and 11,370 tons more than seven-stage atmospheric crude.

TABLE 3. Composition of crude recovered at 10 psi and 80 F in the seven-stage stabilization from 1,000,000 tons of crude.

	Tons	% Recovery
Carbon dioxide	110	1.47
Methane	60	0.08
Ethane	2,340	11.57
Propane	11,020	43.53
Butanes	16,220	71.43
Pentanes and other hydrocarbons up to 150C	144,210	97.04
Hydrocarbons above 150C	697,000	100.0
Total	870,960	.....
Gas evolved	14.163 m.c.f.d.	

The butane recovery is now 71.43 per cent, which is 7.5 times the recovery for single-stage atmospheric crude and an increase of 22 per cent over seven-stage atmospheric crude. There is, of course, a marked increase of propane and ethane retention, which remain in solution in the crude until it reaches the refinery. These lighter components retained in the crude by multi-stage stabilization and especially in the "10-lb crude" are of value as refinery fuel.

The volume of gas has again decreased and is now 15.5 per cent less than the gas evolved in single-stage atmospheric crude and 3 per cent less than seven-stage atmospheric crude.

Table 4 which is an extract from a typical Production Sheet from the Agha Jari seven-stage unit gives an example of seven-stage stabilization in actual practice.

TABLE 4. An extract from a typical production sheet from the Agha Jari seven-stage production unit.

Stage No.	Pressure psi gauge	Average temperature		Gas offtake million cu ft per day	Gas/oil ratio vol/vol
		Oil F	Gas F		
1	1,045	130	85	69.00	93.00
2	442	127	109	19.27	25.96
3	177	125	123	9.64	13.00
4	72	123	119	5.19	7.00
5	41	122	115	3.78	5.08
6	21	120	115	2.22	2.99
7	10	118	112	1.52	2.03
Total	.....	...	...	110.62	149.06

Output of production unit 130,000 U.S. barrels/day
of which 90,000 barrels per day was "10-lb crude"
40,000 barrels per day was "atmospheric"

This means that 90,000 bbl of crude were drawn off the plant between the sixth and seventh stages and dispatched to the refinery with a gravity of about 35 API.

The remaining 40,000 bbl passed through the seventh (or atmospheric stage) for dispatch to export at a gravity of about 34.4 API.

Production Units

The oldest field in Iran is Masjid-i-Sulaiman where the flowing pressures are very low, wellhead pressures being in the neighborhood of 50 psi. Multi-stage separation in the strict sense of the word cannot, therefore, be applied to this field. However, the wellhead separators which are all of the horizontal type are operated where possible at a pressure of 30-35 psi,

TABLE 2. Composition of crude recovered at atmospheric pressure from 1,000,000 tons of reservoir crude.

	Single-stage separation		Two-stage separation		Seven-stage separation	
	Tons	% Recovery	Tons	% Recovery	Tons	% Recovery
Carbon dioxide	30	0.40	40	0.50	10	0.13
Methane	140	0.18	110	0.14	.....	.....
Ethane	230	1.14	450	2.2	730	3.65
Propane	900	3.56	2,430	9.6	6,670	26.33
Butanes	2,170	9.56	6,080	26.8	13,290	58.52
Pentanes and other hydrocarbons up to 150C	102,800	69.20	127,980	86.1	141,890	95.48
Hydrocarbons above 150C	695,850	99.83	697,000	100.00	697,000	100.00
Total	802,120	.....	834,090	.....	859,590	.....
Gas evolved	16.76 m.c.f.d.		15.833 m.c.f.d.		15.227 m.c.f.d.	

and the gas separated off, which is rich in gasoline, is collected in the gas mains for further processing. The crude is then run into flow tanks where the remainder of the gas is separated off at atmospheric pressure, thus giving a two-stage separation.

The separated gas contains an appreciable quantity of hydrogen sulphide and is, therefore, processed in a sulphur extraction plant which produces up to 40 tons of sulphur daily, and then passed to a gasoline absorption plant. The gasoline produced is pumped with the crude to the Refinery at Abadan. The stripped gas is delivered to the mains for domestic and industrial use.

Haft Kel Production Unit

The first field to be equipped with six-stage stabilization units was Haft Kel in 1930. Three of these production units are now operating on this field producing a daily total of 210,000 U. S. bbl of "10-lb crude." The flow head pressures on this field are sufficiently high to allow efficient stabilization units to be used. The operation pressures for the six stage are of the order of 500, 200, 100, 40, 20, and 10 lb per square inch gauge. The high pressure separator is at the wellhead and the separator vessels for the remainder of the stages are located in the production unit sites.

Perhaps the most interesting of the production units because it is so fully instrumented that the production can be automatically controlled from a control room several miles away is the Gach Saran stabilization unit, a description of which follows:

Gach Saran Unit

Gach Saran was the second oil field in Iran to produce by the multi-stage stabilization method, the installation having been completed in the year 1940, with a capacity of 150,000 bbl per day. This installation includes many improvements which were the outcome of studying conditions in the Haft Kel production units and a number of innovations were introduced. A very important factor which had to be taken into account when designing the Gach Saran production system was the higher wellhead pressure encountered on this field as compared with Haft Kel.

At present there are three producing wells at Gach Saran giving a total production of 37,000 bbl per day which is the maximum capacity of the pipe line carrying the crude to Abadan. The flow head pressures vary from well to well between 1110 psi to 970 psi. The wells, which are fitted with high pressure flow heads, are directly connected to first stage separators, which have been erected close to the wellheads, thus following the original layout of the Haft Kel field.

Automatic flow limit valve at Agha Jari.

Each well flows into its wellhead separator where the high pressure gas is separated off at a pressure of approximately 950 psi the crude passing to the second stage known as the intermediate stage.

The level of the crude in the wellhead separators is regulated by a liquid level controller, which operates (a) the automatic control valve in the crude line between the wellhead and the separator, (b) a back pressure regulator in the gas outlet pipe, (c) a back pressure regulator in the crude outlet line. The level of the liquid in the separator controls the opening of the pilot-operated back pressure regulator in the crude line between the wellhead and the separator, and at the same time controls the rate of flow of the well. This valve receives its supply of gas for the pilot operation from the high pressure gas offtake of the wellhead separator and it is so constructed that any failure of gas to the pilot will close the valve and so shut in the well.

Part of the gas separated off this vessel is used expansively in a small lighting set for local lighting and some is used for domestic and industrial purposes.

This installation also includes a device which allows each well to be shut in or opened up by a push button in the production control room at Ab-i-Shirin several miles distant.

Each well and its respective wellhead separator installation is fenced around, kept locked and is completely unattended, being visited only for the routine inspections.

The crude on leaving the wellhead separator passes to the intermediate stage or second stage of stabilization at distances varying between a half and two and a quarter miles from the wellhead separators, at a higher elevation. There are two second stage separators one being served from wells on the northeast flank of the structure and the other receiving from wells on the southwest flank. They are situated between the wellhead separators and the main stabilization unit. Operation of these vessels is similar to that of

the wellhead separators and they are entirely automatic being fenced in and unattended. Pressures at this stage are between 400 psi and 440 psi. The main production unit is situated on the highest point of the field at 3000 feet above sea level whence the stabilized crude can flow by gravity, aided by a very light boost, to the Abadan refinery 166 miles away. The unit primarily consists of five stabilizer vessels to handle crude at the following range of separator pressures 120, 40, 25, 15 psig and atmospheric pressure. The pressures vary with the temperatures as explained above and normally the operator works to a table showing the equivalent pressures for the required pressures at 80 F.

Crude from the intermediate stages enters the manifold and passes through the regulating valve operated by the liquid level controller of the first vessel of the main unit which constitutes the third stage of separation, entering at a pressure of 120 psi. The gas evolved, on leaving the vessel passes through the back-pressure regulators on the gas line, thus holding the necessary pressure on the separator. The crude leaving the third stage is taken into the fourth stage through the level-controlled regulator and the process is carried on until either the 10 psi vessel or the atmospheric vessel is reached depending upon the type of crude demanded by the refinery.

A part of the gas produced is used expansively to drive the boosting pump and a part for the lighting set servicing the unit.

Production System at Agha Jari

The most modern of the production units, and incidentally the one processing the largest volume of crude oil is the Agha Jari No. 1 production unit. Although it does not boast of all the refinements of the Gach Saran unit, which was built at a more leisurely pace allowing time to be spent upon such devices as remote hand wheel and push button control, it is still a fully automatic unit in the strict sense of the word. Due to constant study of the conditions underlying the multi-stage stabilization and by means of adjusting operations the throughput of the main seven-stage unit has been doubled since it was first erected with no ill effects either upon the operation of the plant or the quality of the crude produced.

The present system at Agha Jari consists of three production units in what is known as the Agha Jari No. 1 production area. The three units are:

(a) a permanent seven-stage unit, referred to above, of 170,000 bbl per day capacity.
(b) a temporary six-stage unit of 45,000 bbl per day capacity and
(c) a temporary double-flash unit of 25,000 bbl per day capacity.

The temporary units were put together during the war from materials and salvage at hand at the time in order to allow the field to be put into production quickly to fill much needed war time demands for oil. These units are still in use today but will be released from service as other permanent units are commissioned.

The production of the Agha Jari field then, is handled by these three units of No. 1 production area whose combined capacity is 240,000 bbl per day, and they are served by all the producing wells in this growing field which at present number eleven.

To withstand the high flowing pressure between 1200 and 1700 psi each well is fitted with a modern high pressure flow head. Between the flow head and the flow line is inserted a flow limit valve, which is, in effect, a safety device which will close, and thus shut in the well, if the flow of oil through it exceeds a predetermined figure, thus preventing both unstable conditions in local offtake and possible damage to casing from undue drop in wellhead pressure. Unlike the installation on the other fields.

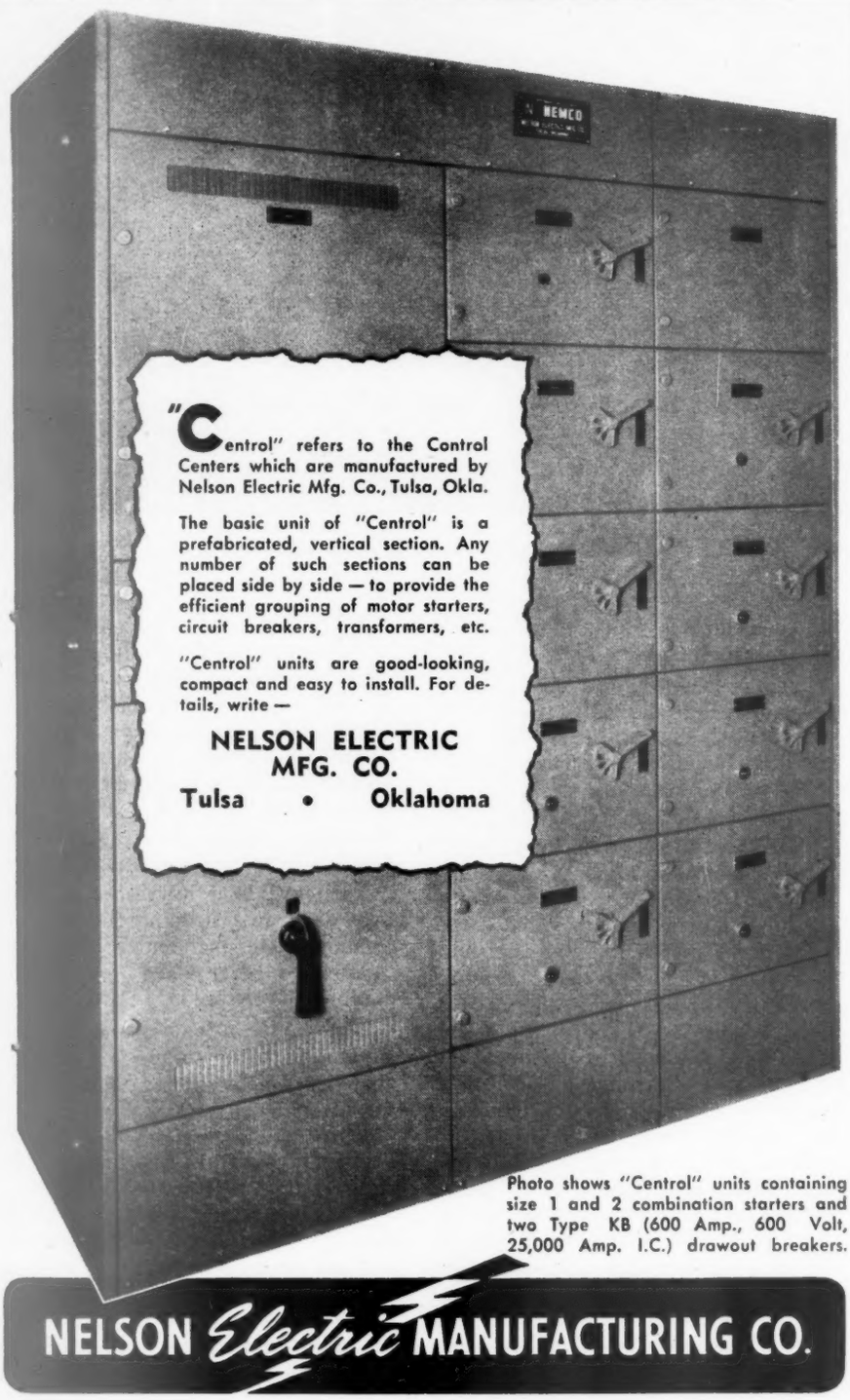
"Central" refers to the Control Centers which are manufactured by Nelson Electric Mfg. Co., Tulsa, Okla.
The basic unit of "Central" is a prefabricated, vertical section. Any number of such sections can be placed side by side — to provide the efficient grouping of motor starters, circuit breakers, transformers, etc.
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Photo shows "Central" units containing size 1 and 2 combination starters and two Type KB (600 Amp., 600 Volt, 25,000 Amp. I.C.) drawout breakers.

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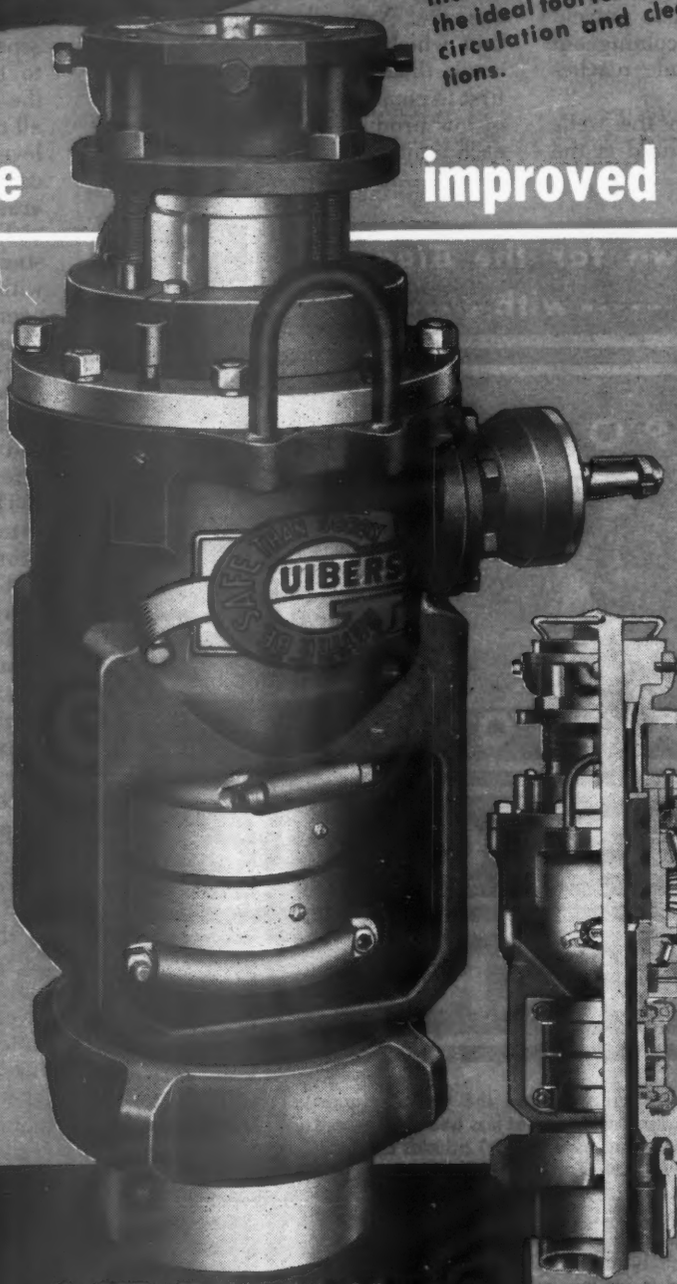
REINFORCED HEAD WILL NOW HANDLE TUBING STRINGS UP TO 8,000 FEET IN DEPTH

•



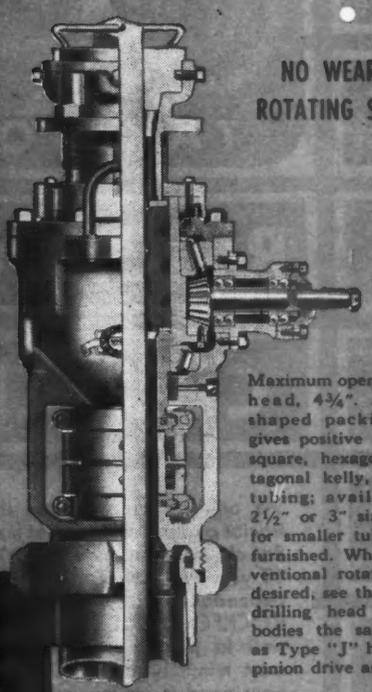
PACKINGS EQUIPPED WITH LUBRICATION FITTINGS

•

PACKING ASSEMBLY REPLACED WITHOUT DISMANTLING HEAD

•

NO WEAR ON ROTATING SPINDLE



Maximum opening through head, 4¾". Accordion-shaped packing rubber gives positive seal around square, hexagonal, or octagonal kelly, as well as tubing; available in 2", 2½" or 3" sizes; rubbers for smaller tubing can be furnished. Where the conventional rotating head is desired, see the Type "K" drilling head which embodies the same features as Type "J" head without pinion drive and gear.

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there are no wellhead separators, the first stage separators being located at the stabilization units. All the wells flow under their own pressure to the production area through high pressure pipelines the length of which may vary between three-quarters of a mile and four and one-quarter miles. Full flow head pressure (less pressure drop in the line) is maintained in these lines between the wells and the manifold of the production unit to prevent excessive volumes of gas coming out of solution before the crude reaches the separating system.

All the flow lines from the wells come together into a manifold at the production area. Before entering the manifold, the crude passes through reducing valves where the pressures on all flow lines are reduced to a common manifold pressure of 1180 psi. From this manifold crude can be fed into all the three units.

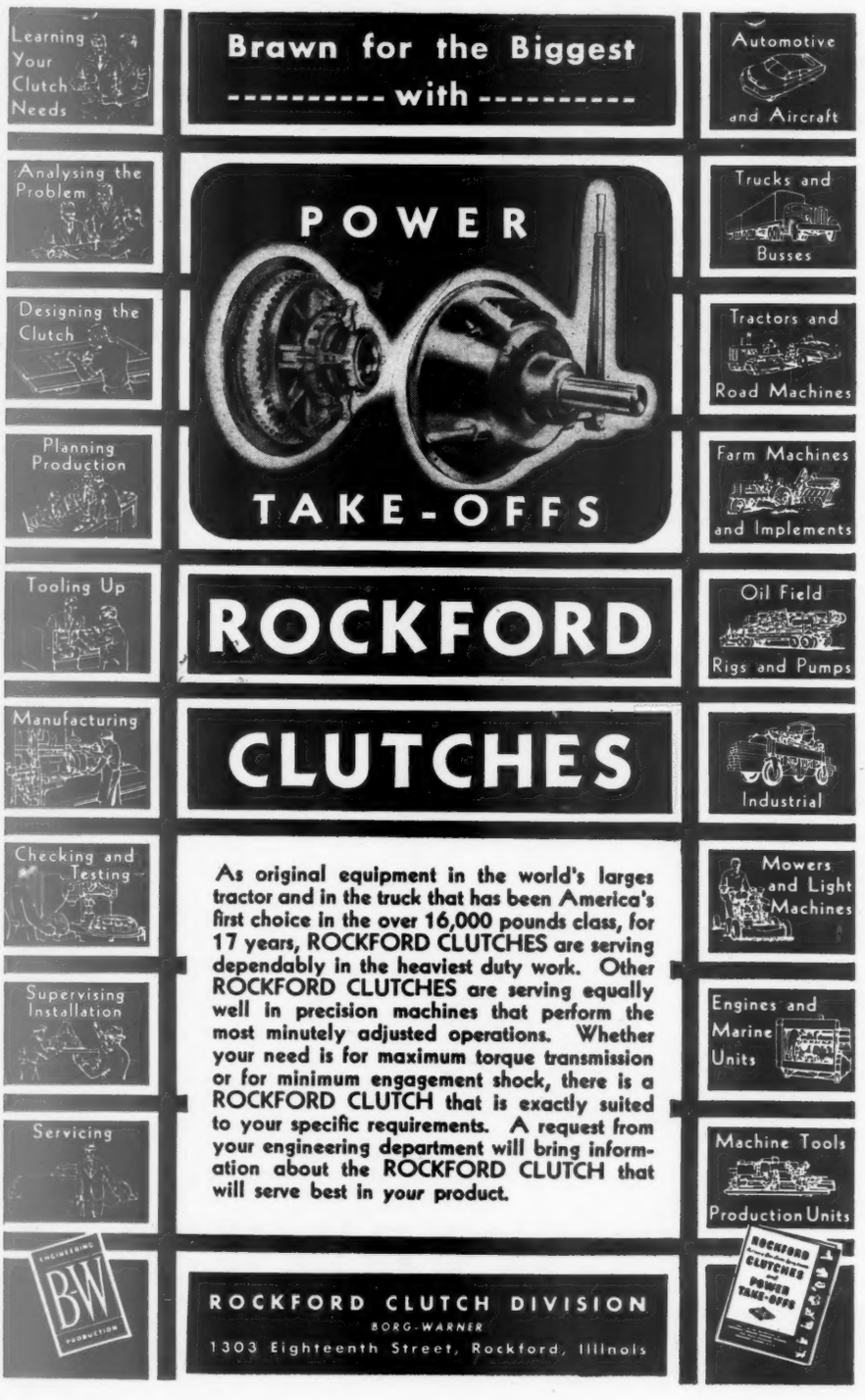
The main or permanent unit takes crude up to its full capacity while the other units take the remainder up to the volume of crude required by the refinery. Naturally, the double flash unit which produces a lower quality crude than the other two units is the first to come off stream during periods of low production. The throughput of each unit is controlled by the speed and, therefore, the output of the main oil line pumps, while a stoppage for any reason in the plant will shut down the whole plant and shut in all the wells connected to it, as well. The main unit has nine horizontal separators of the latest type, as previously described, connected up to the crude lines so that the first two are in parallel and the rest in series. A control valve operated from the liquid level controller of the first stage of separation, governs the flow of crude to the first stage. The remainder of the stages consists of one vessel each, all of which are equipped with liquid level controllers operating automatic control valves on the inlet to the separators.

The separator vessels from the third stage to the sixth stage are equipped with combined temperature pressure controllers which vary the actual pressure on each vessel according to the crude temperature. The pressures maintained in the various stages are of the order of 850, 360, 180, 80, 40, and 15 psig, and atmospheric pressure.

The back pressure on the separators is maintained by back-pressure regulators. The gas outlet from the two first vessels has three valves in series to reduce the gas pressure in three stages from 850 psi to the pressure required in the gas offtake lines, since the pressure reduction in one stage would cause unnecessary complications. The gas passes through the metering orifice and into the gas lines, since the high pressure gas is used expansively to drive gas expansion turbines for pumping the stabilized crude and for generating the power used both in the plant and on the rest of the field thus using to advantage the pressure energy in the gas. The remaining stages have one back pressure valve only on each of the gas outlets. Each gas line has an orifice meter for measurement of the gas offtake from each stage to be able to maintain an effective check on the operation of the plant.

Three 800 psi main oil line pumps are used to deliver the production of the permanent unit to the pipe line system. The gas supply lines to the turbins of these pumps are fitted with control valves operated by the levels of the vessels in the last two stages. The function of these control valves is to prevent the emptying of the last stage vessel to which the suctions of the pumps are connected.

The elevation of this Production Unit is 1069 ft above sea level and gravity flow to Abadan is possible. The boosting pumps, however, allow the full capacity of the pipe lines to be utilized. * * *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PART 2

Hydraulic Torque Converters and Fluid Couplings for Oil Field Machinery*

H. A. DAVIS†

Section II.

Hydro-Kinetic Applications

To facilitate cross reference, the same sequence will be used in presenting this section on hydro-kinetic unit applications as was followed in Section I.

Traction Type Couplings

Fig. 5 (a) presents a photograph of a hydraulic coupling which is part of the drive of an air compressor as mounted on a truck body and powered by the truck's engine. The compressor, a Worthington piston type, 6 by 5 by 5 is driven by a conventional International Model BLD 6 cylinder truck engine which is rated at approximately 60 horsepower at 2100 rpm. The coupling on this application is used to isolate the engine and truck transmission from the repeated peak shock impulses which would otherwise be imposed on the system by this heavy duty compressor. Sketch 5 (b) shows the power flow diagram of the unit. Note that when the truck is going over the road the power is flowing in the conventional manner to the rear wheels, but when upon location a positive clutch in the power tower unit shifts the flow of power into the compressor system. A regulator not shown in the picture controls the engine throttle, cutting the engine back to idle speed when the receiver air pressure reaches 125 psi maximum. At idling speed of the engine, the horsepower delivered is negligible and the hydraulic coupling has sufficient capacity to continuously reject the heat generated, due to 100 per cent slip. It is therefore unnecessary to provide a friction clutch to engage or disengage the compressor during each work cycle. On this installation the obvious advantages of a hydraulic coupling are: Material reduction in transmission, clutch, and engine maintenance costs, a smooth more even work cycle, and protection to the engine against stalling.

Slim Hole Drilling Rigs

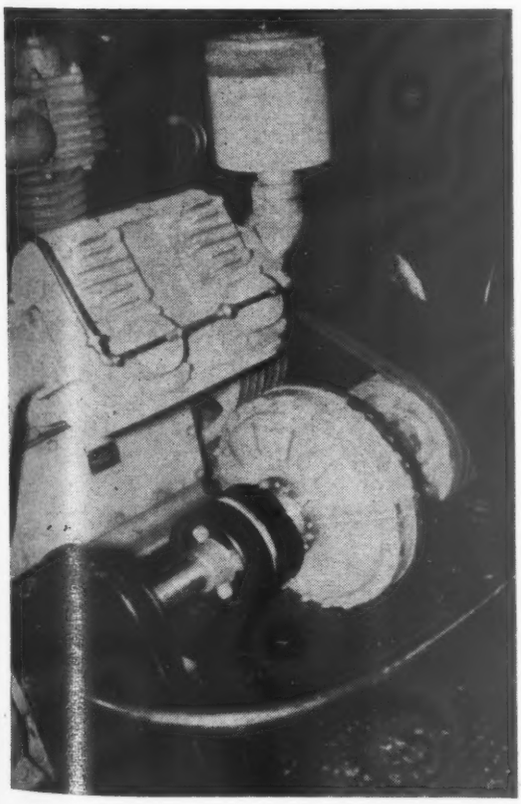
The photographs, Fig. 6 (a) and (b) show two well known makes of slim hole drilling rigs which employ hydraulic couplings mounted directly into the engine flywheels. On these rigs the traction couplings serve a variety of purposes, such as to help synchronize the two engines when clutched together for hoisting (that is within the limits of allowable slip); to iron out the shock loads from rotary table, pump, and hoist drives; and to prevent the engines from being stalled under any condition due to rough or inexperienced handling by the drilling crews. On rigs of this type designers often find that reduced sizes of clutches, shafts, and bearings, can be used because of the cushioning effect of the hydraulic coupling.

Photograph 6 (c) shows the hydraulic coupling application on still another slim hole rig. Here the manufacturer saw fit to follow the coupling with a built-in power take-off clutch. This clutch offers complete disengage-

*Presented before Petroleum Mechanical Engineering Conference of American Society of Mechanical Engineers, Amarillo, Texas, October 3-6, 1948.

†Twin Disc Clutch Company, Dallas, Texas.

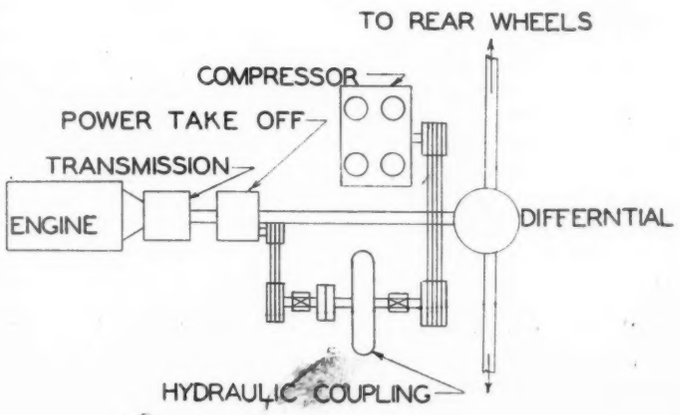
(a)

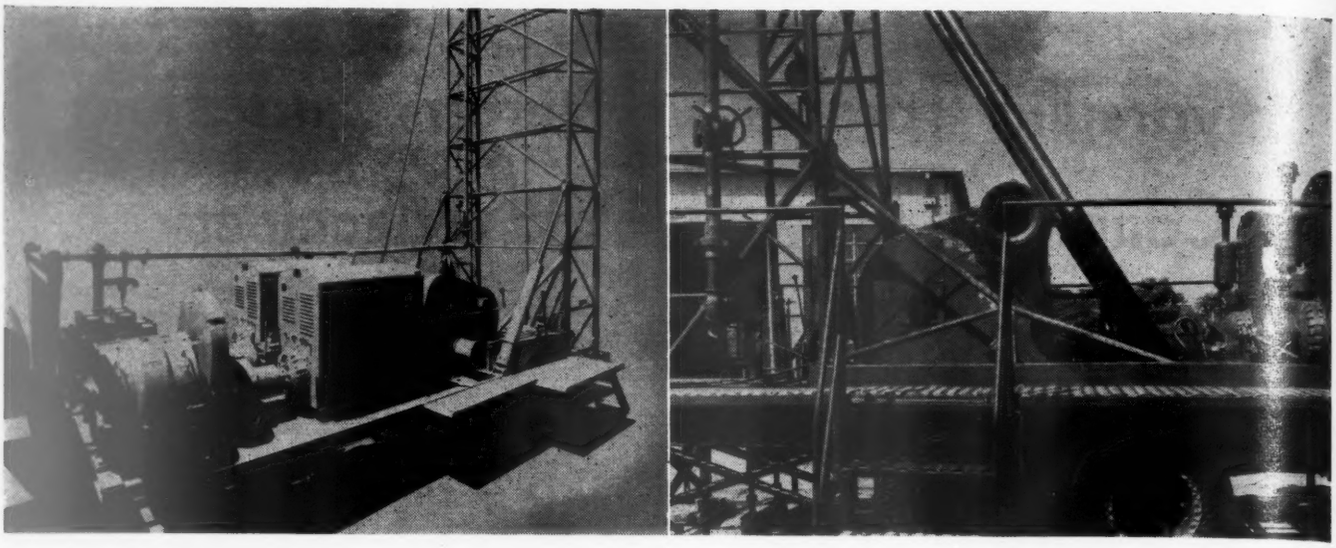


Traction Type Couplings

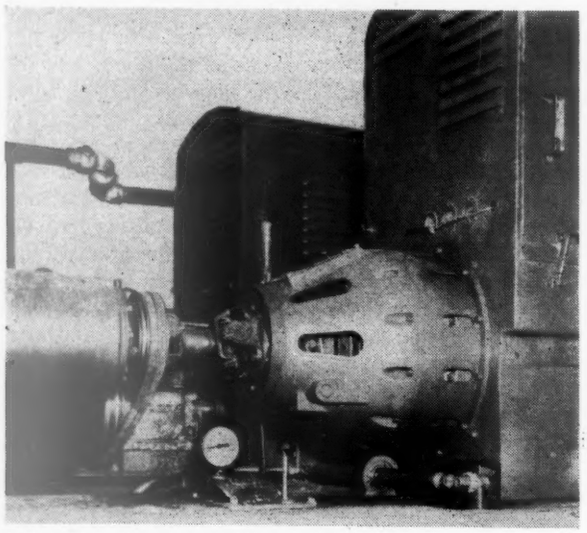
FIG. 5. Air-compressor drive.

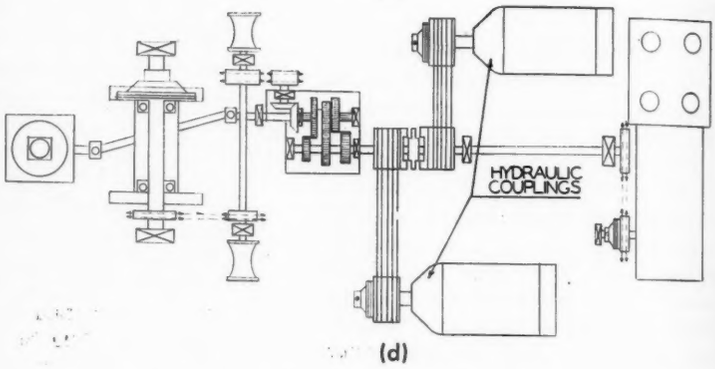
(b)





(a) (b)





(c) (d)

FIG. 6. Slim hole drilling rigs.

ment of the power unit to facilitate speed changes or redirection of power flow during rig operations.

Power flow diagram 6 (d) is typical of coupling applications as found on slim hole rigs. The extensive use that designers have made of couplings indicates that they fully understand the following advantages; light weight per horsepower, low cost, a close coupled means of obtaining a fluid cushion, and protection to the power unit as against stall.

Cementing Pump Truck

Fig. 7 (a) and (b) are photographs of a new type of cementing truck which uses a very unique combination of hydraulic coupling and torque converter drives to accomplish the desired results. For over-the-road operation the truck is normally powered by the right hand engine, (please refer to power flow diagram shown in Fig. 7 (d) which drives through a traction type coupling into a special five speed transmission and then into the wheels. For emergency road operation, it is possible to clutch in the left hand engine and drive through the converter to the wheels. On location, the left hand engine with coupling and transmission powers the cementing pump which handles the high pressures required for squeezing and other similar high-pressure cementing operations. The right hand engine with torque converter is used for mud mixing, high volume displacement, and for compounding into the suction of the high pressure pump.

The advantages of the hydraulic units on this cementing truck are quite apparent. Of greatest importance is the fact that the engines cannot be stalled under any condition; that the cushioning effect on the various drives reduces wear and premature failure of critical parts; and lastly, that the pumps can be started up as against any pressure within their capacity, without the use of by-pass valves.

Photograph 8 (a) shows an electric motor and hydraulic coupling application. Curves 8 (b) indicate the performance obtained by the combination of the squirrel cage induction motor and traction hydraulic coupling. The curves show the acceleration of the motor and of heavy enertia load typical of conditions found in an oil field beam type pumping unit installation. The motor attains approximately 75 per cent of full load speed before the coupling circuit functions to engage the load. The motor then continues to accelerate and the load is automatically picked up by the coupling, until full load speed is obtained. The difference between motor speed and coupling output speeds represents slip, or the cushioning effect which helps the coupling dampen peak torque loads.

The advantage of fluid coupling drives on beam type pumping unit applications are now being studied by several major oil companies and it is expected that a number of interesting installations will be made in the near future. Some of the advantages which accrue to installations of electric motors are as follows:

1. The ability to use automatic starting equipment without the fear of overloading the power unit during the starting up and acceleration period.

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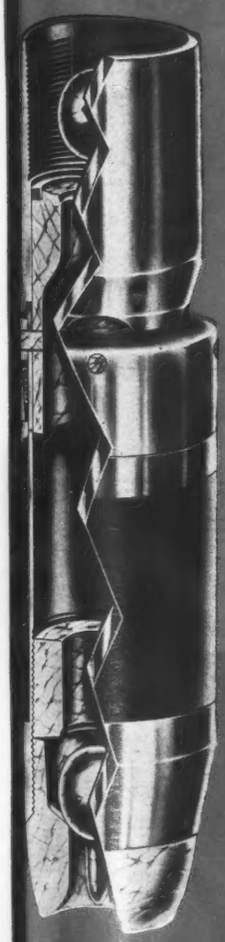

Cut-away view of Larkin CEMENTROL Shoe before setting.

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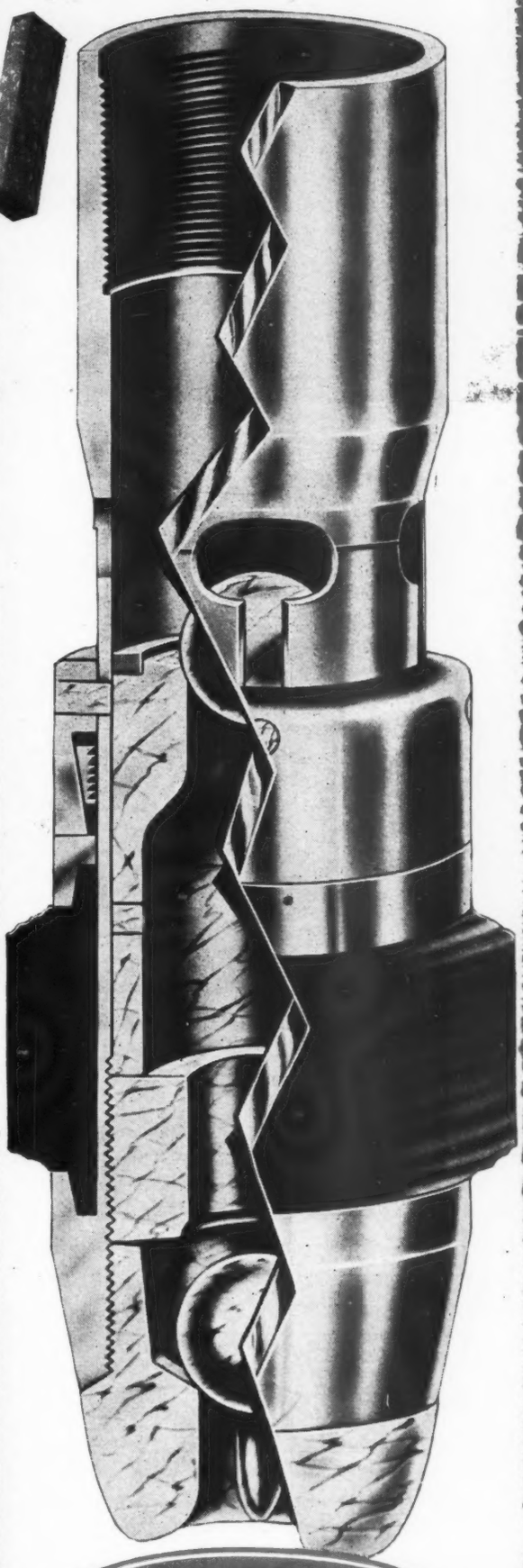

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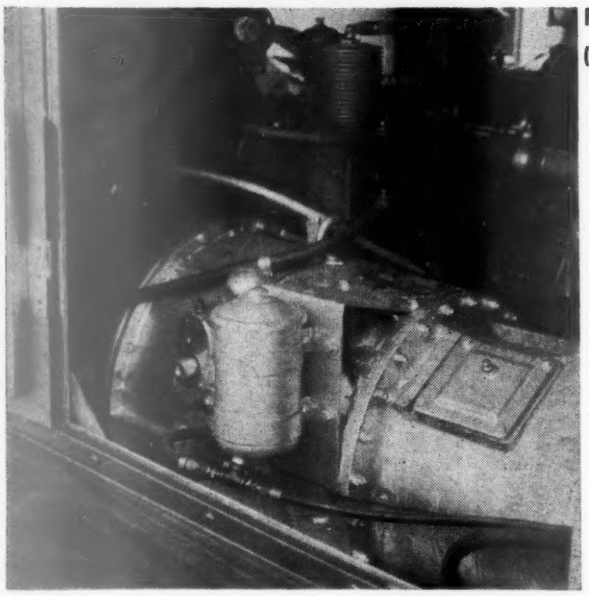
(a) Hydraulic coupling engine.

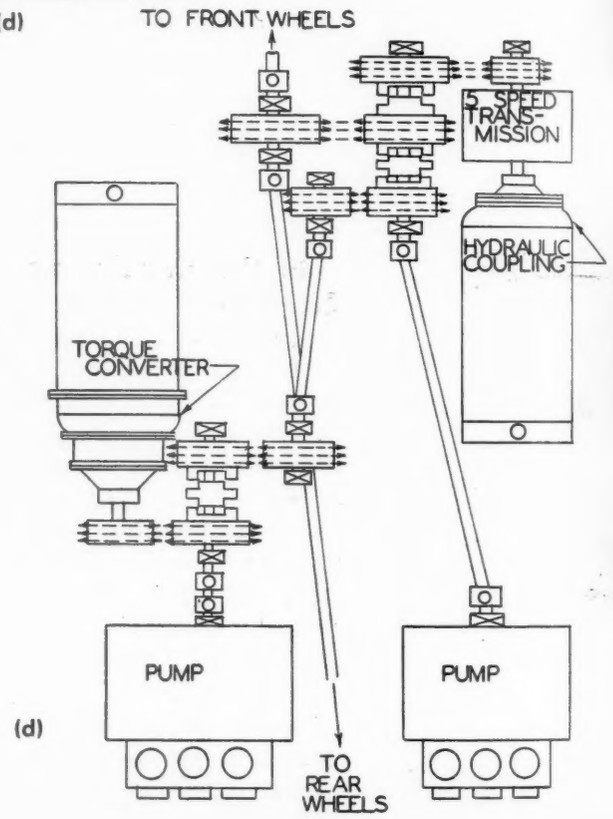
(b)

FIG. 7. Cementing pump truck.



(c) Hydraulic torque converter engine.

(a) (b) (c) (d)



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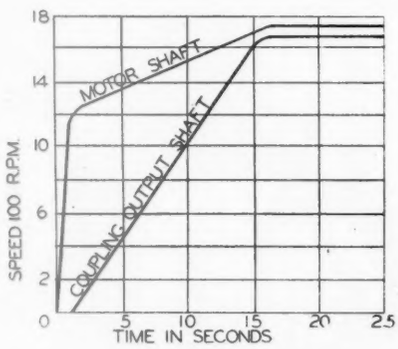
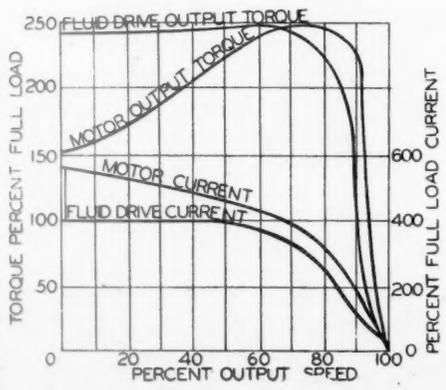
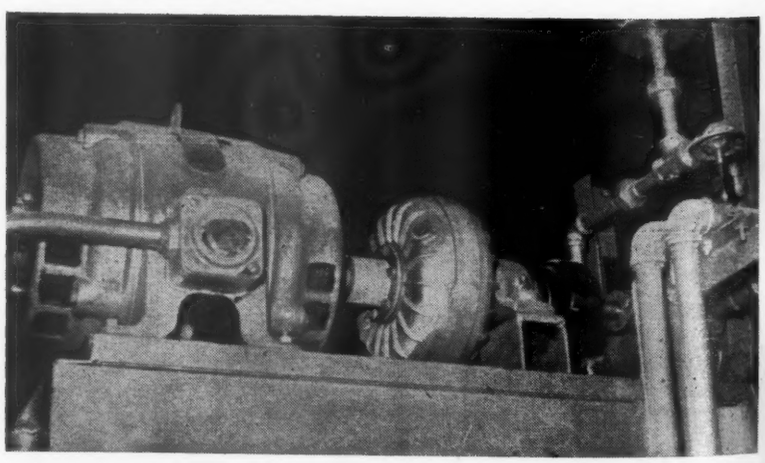




(b) FIG. 8. Electro fluid drive unit. (a)



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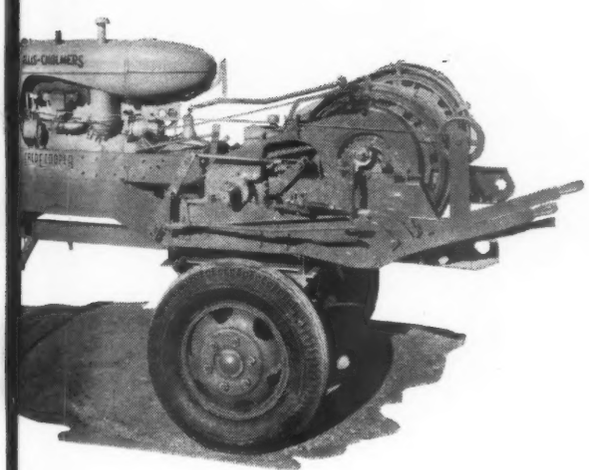

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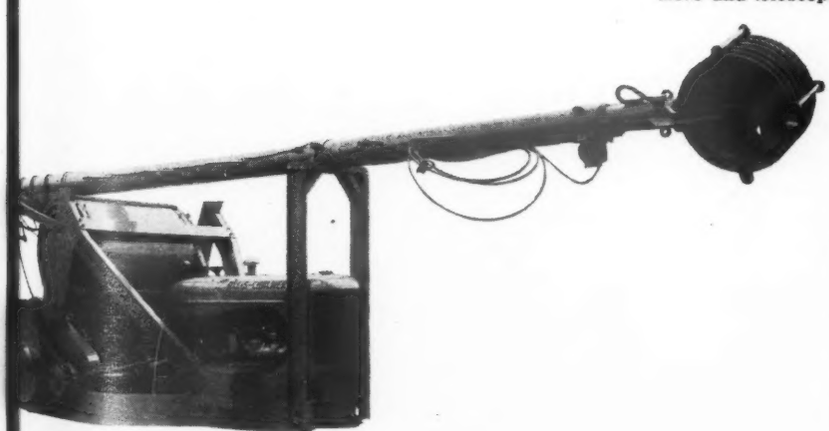

5

This streamlined, mobile well servicing unit is designed around the rugged ALLIS-CHALMERS Model W Engine and COOPER patented pulling equipment. It's adaptability, within its range is practically unlimited, as shown in the accompanying illustrations, each unit is a standard production model.

The maximum line pull of the W Unit is 20,666 lbs. The W Engine develops a torque of 128 ft. lbs., continuous operating range is 800—1300 r.p.m. All winch units are equipped with Cooper patented circulating air cooled brakes. Eight pulling speeds are available to 719 ft. p.m. at 1,600 engine r.p.m. Being standard production models, parts are interchangeable and repairs can always be made with factory built parts.

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- **2. Allis-Chalmers W Single Drum Winch Tractor. Maximum line pull is 20,666 lbs. Unit has short turning radius, road clearance 20½". Road speed is 15 m.p.h. maximum, four speeds forward and one reverse. Available with rotary drive and telescoping mast.**

- **3. Allis-Chalmers W Tractor with Centrifugal Pump. A highly mobile auxiliary self-powered pumping unit, for pick-up and transfer operations. Also adapted to pipe line and refinery use.**

- **4. Allis-Chalmers W Trailer Winch, a complete pulling unit to be towed behind a light pick-up or small truck. Its specifications are the same as the tractor. Drum capacity 5,660' of ½" line. Drum is 26" x 33".**

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2. Reduction of peak torque loads which might otherwise be imposed upon the power source and the driven unit.

3. Protection of the power unit as against stall conditions of the driven unit. In this condition, the coupling will allow the motor to pull its maximum torque rating, thereby drawing sufficient current to cause the double overload protective device to function within a few seconds. This is a protection to electric motor installations which cannot be over-stressed.

To summarize traction hydraulic coupling applications, it can be stated here that a coupling can be successfully applied when the application has the following requirements:

1. Critical torsional vibrations to be dampened.
2. Shock loads to be absorbed.
3. When it is essential that the prime mover be kept from stalling.
4. Providing synchronization of two or more electric motors or engines within allowable slip range.

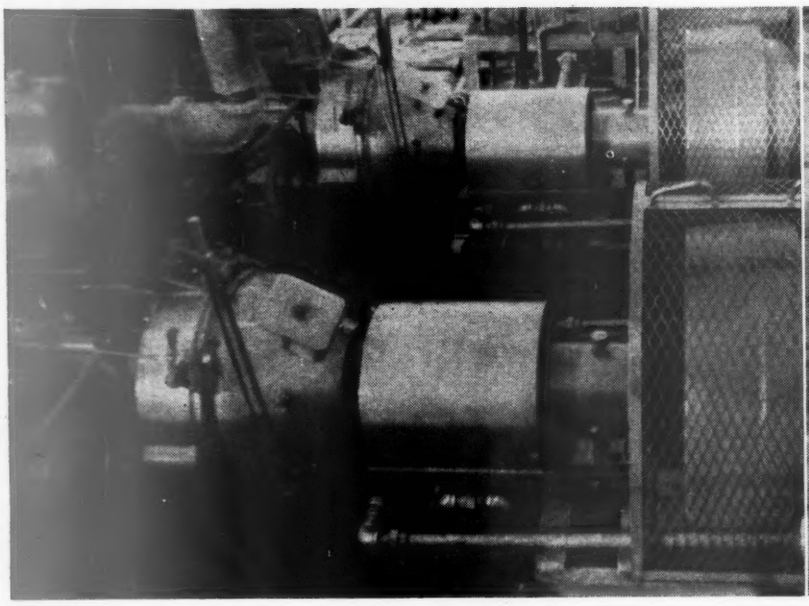
When these requirements are found in equipment design, then a coupling can be justified from an economic as well as an improved performance standpoint.

Scoop Tube Couplings

Photographs 6 (a) and (b) show conventional three engine power rigs using scoop tube type hydraulic couplings between the engines and the compounds. These rigs were built shortly after the war and the couplings are of the manually controlled scoop tube type which must be hand set in order to obtain the desired performance. However, automatic controls have now been developed which are operated from the drillers position.

FIG. 6.

(a)



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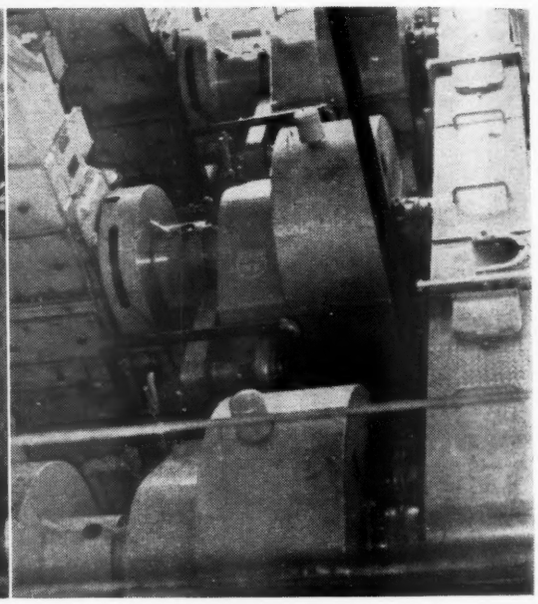

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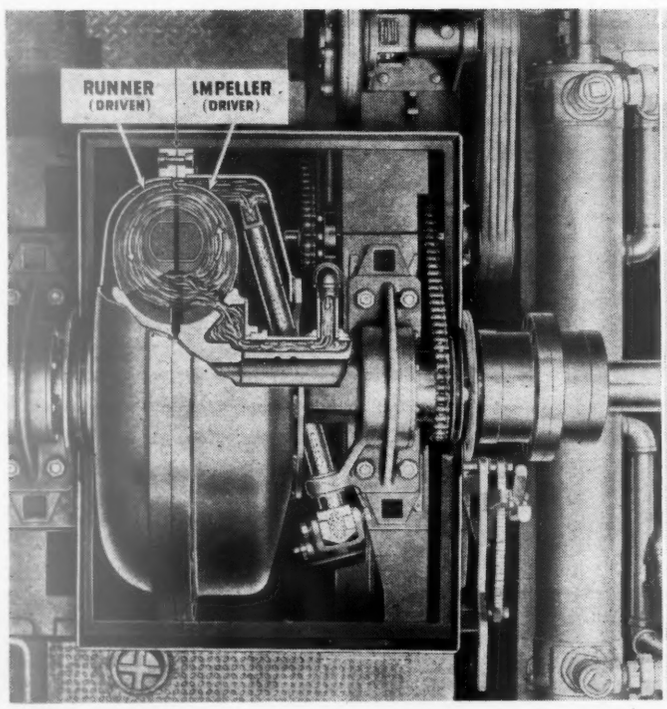
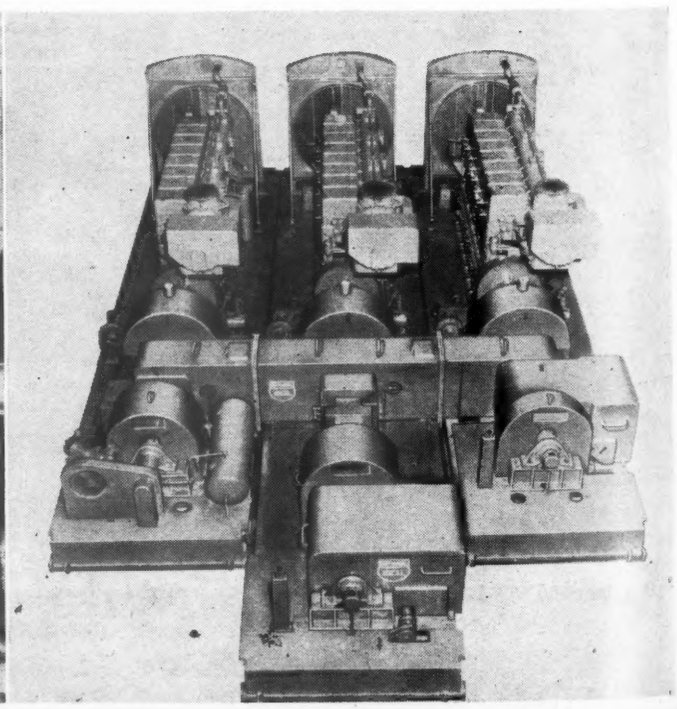


(d)



1

This is the first in a series of interpreted electrical logs from identified formations and fields which Schlumberger will reproduce in this publication. If you would like to keep this entire series, please write to us on your letterhead and we will be glad to send you a reprint of this log and a binder in which you may file subsequent logs as they are published. This series is made possible through the courtesy and cooperation of the oil operators who have released these logs.

LOG ANALYSIS

1) Water saturation S

$R_O = 0.4$ ohm in "X". This value will be used for "B" and "C" sands calculations.

In "B" Sand: $S = \sqrt{\frac{0.4}{29}} = 12\%$ approx.

In "C" Sand: $S = \sqrt{\frac{0.4}{12.5}} = 18\%$ approx.

2) Formation water resistivity R_w

$SP = -90 \log_{10} \frac{R_m}{R_w}$

At water level, in "X", SP = –115 mv.
thus, $R_w = 0.04$ ohm BHT

3) Porosity p

$F = \frac{R_o}{R_w} = \frac{0.4}{0.04} = 10$

$p = \sqrt[m]{\frac{1}{F}} = 28\%$ for $m = 1.8$

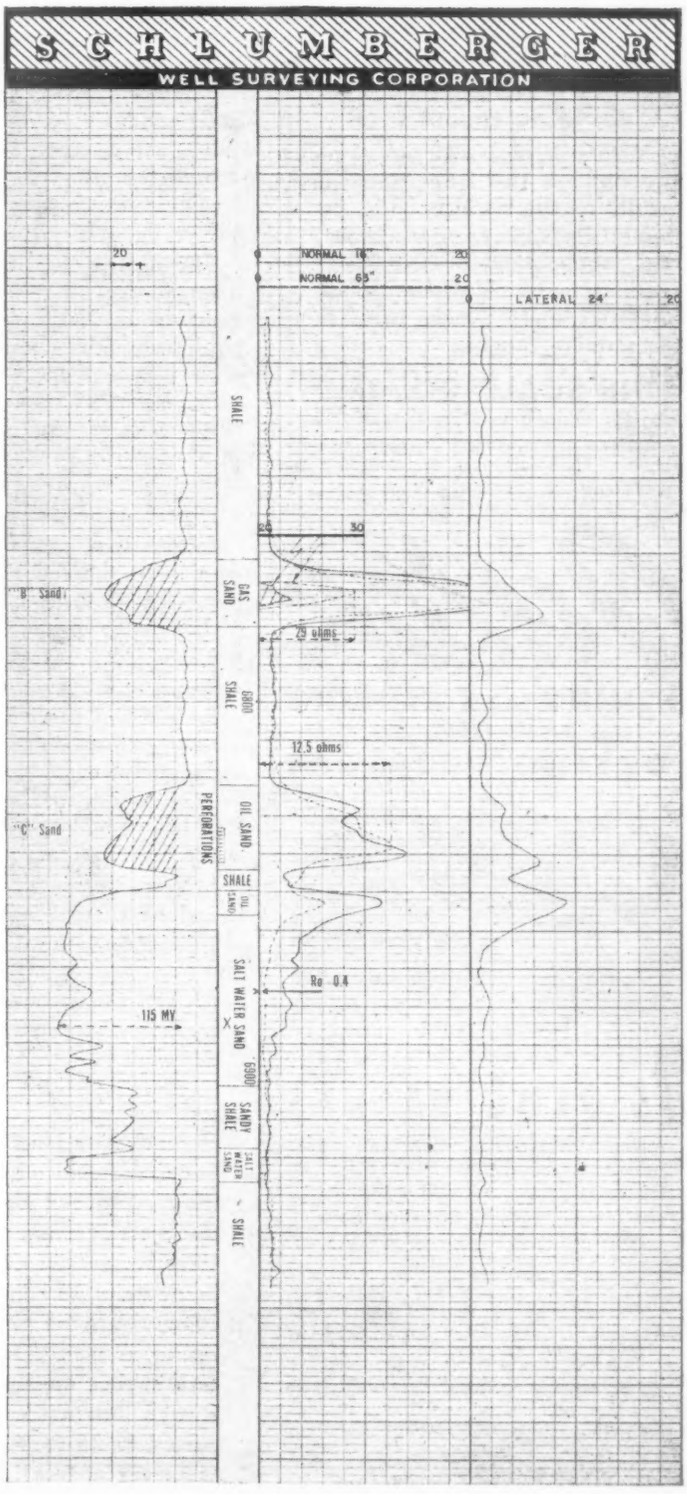
CORE ANALYSIS

B Sand	Porosity	30%
	Permeability	800 md.
	Residual Water	43%
C Sand	Porosity	30%
	Permeability	800 md.
	Residual Water	42%

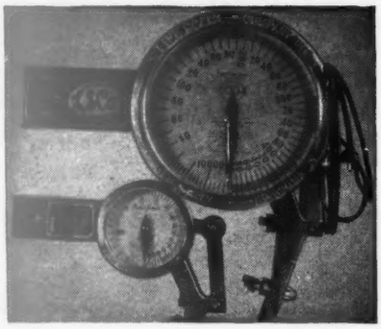
PRODUCTION RESULTS

Perforated: 6833-42 with 24 shots
Potential: 140 bbl. oil 28.3° API
Gas oil ratio 758/1

SCHLUMBERGER
WELL SURVEYING CORP.
HOUSTON, TEXAS



LINE SCALES



(Above) Super 500,000-lb. capacity, 14" dial. (Below) Packer Special, Capacity 40,000 lbs., 6" dial. 18 other models for every drilling, well servicing, or work-over need.

20 MODELS to choose from

With a LINE SCALE you know the pull on the line, and the weight on the bit in pounds. Repeated tests prove the accuracy and dependability of LINE SCALE readings under all working conditions . . . even in areas of rapid temperature changes.

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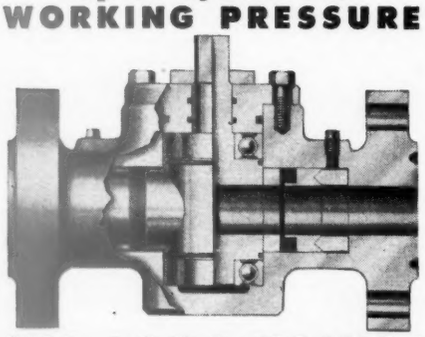
Box 4245 **Oklahoma City** Phone 6-1765
Gulf Coast Representative: Crenshaw Sales Co., Houston, Texas, Box 2031

Quick

OPENING and CLOSING up to 5,000 lb. WORKING PRESSURE



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★ NO LUBRICATION REQUIRED
★ NO TAPERED PLUG TO STICK
★ NO FACTORY SERVICE NEEDED

Available in working pressure range 1,500 lb., 3,000 lb., and 5,000 lb. in 2" to 4" sizes.

Johnson Foundry & Machine Co.
Los Angeles 12, California • Phone: CA-6167
OR SEE:
Oil Field Specialty Company - Houston, Texas Call Charter 4-7031
W. G. Corbitt - Casper, Wyoming - Call 1750
In California
Bethlehem Supply Company

Photographs 6 (c) and (d) show a cut of this new type coupling and a recently assembled rig on which they have been installed. On this rig the scoop controls are actuated by air which moves the scoop in a horizontal sliding slot, thereby increasing or decreasing the level of oil in the fluid working circuit. In this manner the driller can obtain variable torque and power for the different operations of the hoist, rotary table, and slush pump drives, and therefore can run the rig most efficiently.

The pipe and fittings seen in the foreground of Photograph 6 (a) are used to conduct the coupling fluid out of the working circuit through a heat exchanger and then back into the center of the coupling for further work. As previously explained, these couplings can be continuously operated at a high rate of slip, with the resulting loss in horsepower removed as heat in the exchangers.

During the last two or three years a considerable number of large power rigs, from 900 hp up, have been equipped with scoop tube couplings with very satisfactory operating results. Many of these rigs have been shipped to foreign oil fields because of the added protection needed for critical parts when operated by inexperienced native drilling crews.

Generally speaking, small rig applications of the scoop tube type couplings have not been feasible because of the high original cost and weight per horsepower transmitted.

Since these couplings were originally devised there have been some seventy million horsepowers of applications. However, most of these have been of an industrial nature and therefore have not been discussed in this paper.

In summing up the advantages obtained by the use of the scoop tube coupling, they may be listed as follows:

1. The engine may be started and brought up to speed as against no load at any time, since the coupling may be bled entirely dry of all fluid in the working circuit. In this condition, the scoop tube coupling acts not only as a coupling but also as a cut-off clutch.
2. By gradual introduction of fluid into the working circuit, it is possible to start the load very smoothly with the engine running at full rpm.
3. By varying the slip or fill of the coupling, two or more slush pumps may be be compounded in series or parallel.
4. The coupling can operate continuously at a high efficiency of 96 per cent to 97 per cent.

* * *

☆ ☆ ☆

Production time in the manufacture of cold rubber has been greatly reduced because of the discovery of a new chemical. The chemical permits cold rubber to be made at 14 F in only 75 min, compared to the 12 to 16 hr previously required. At 4 F below zero rubber can be made in 5 hr with this new chemical, contrasted to 25 to 30 hr normally necessary at that temperature.

You can be SURE with a JENSEN

What does a producer expect from a modern pumping unit?

Of course, we can't speak for all, but most of our friends give theirs like this: reasonable purchase price, proven design, rock-bottom operation and maintenance costs, dependability and long life.

And these are the things that have been built into Jensen units for 30 years. They are the things that make every Jensen owner SURE he is getting the most from his pumping unit money.

Before you invest another cent in pumping units, check on Jensens; it's easy to "bet" on a sure thing.

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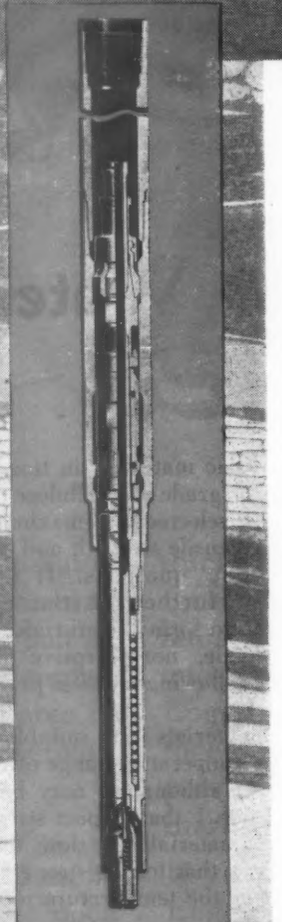
BROTHERS MFG. CO.
Coffeyville, Kansas, U. S. A.
Export Office: 50 CHURCH STREET
NEW YORK CITY

OTIS

REMOVABLE BOTTOM HOLE REGULATORS



Type DB Regulator—made up of a D Regulator Cage Assembly and a B Mandrel Assembly—can be set (and pulled) anywhere in the tubing string without previous installations of Otis Landing Nipples.

Use of a Type DJ Regulator made up with a J Mandrel Assembly which seats in a J Landing Nipple previously installed in the tubing string, is recommended for depths where the temperature is 185°-350° F and the well pressures are extremely high.

Where greater than 1,500 p.s.i. pressure reduction is needed at a single point, two Type DS Regulators can be set in tandem, thus reducing the pressure and flow across a single valve and valve seat. Only one Type S Landing Nipple and Mandrel Assembly is needed for tandem installations.

There are three types of Otis Removable Bottom Hole Regulators (Types DS, DJ, and DB). Each has been engineered to regulate pressures according to specific well conditions. Consult the nearest Otis office for detailed recommendations on the Regulators you need.

PREVENT FLOW-LINE FREEZE-UPS
ELIMINATE SURFACE HEATERS
REDUCE SURFACE PRESSURE

Here's surface-controlled, high-pressure production with all the advantages of bottom hole choking.

By moving the point of pressure reduction from well connections to a point in the tubing where sub-surface heat is high enough to compensate for an extreme drop in temperature, Otis Removable Bottom Hole Regulators offer the best and safest means of eliminating flow-line freeze-ups, reducing surface pressures to safe, workable limits, and eliminating the installation and maintenance expense of surface heating equipment.

Otis Regulators are installed and removed under pressure on a steel measuring line and are set with standard Otis locking and pack-off assemblies according to individual well conditions. The mechanism of the Otis Regulator consists of a double-acting, spring-loaded valve arrangement which is pre-set to allow a controlled amount of flow to pass through the Regulator according to the setting of the surface choke. The unique design of the valve also makes it possible for a well to be killed by reversing the flow and pumping down through the Regulator without pulling the tool.

For complete information and descriptive literature on the many advantages of the Otis Bottom Hole Regulator, contact your nearest Otis field office, or write to Otis Pressure Control, Inc., Box 7206, Dallas.

PRESSURE CONTROL — OTIS — SERVICE – EQUIPMENT

OTIS PRESSURE CONTROL, INC.

BOTTOM HOLE REGULATORS

(T-32)

DISTRIBUTORS: **OTIS PRESSURE CONTROL, INC.**, DALLAS, TEX.; **OTIS EASTERN SERVICE, INC.**, BOLIVAR, N.Y.; **WESTERN PRESSURE CONTROL**, LOS ANGELES, CALIF. FIELD OFFICES: **TEXAS:** HOUSTON, CORPUS CHRISTI, FALFURRIAS, VICTORIA, ODESSA, and LONGVIEW. **OKLA.:** OKLAHOMA CITY. **LA.:** NEW IBERIA and HOUMA. **MISS.:** BROOKHAVEN EXPORT SALES AND SERVICES: **OTIS PRESSURE CONTROL EXPORT, INC.**, POST OFFICE BOX 7206, DALLAS, TEXAS, U. S. A.; CARACAS, SOUTH AMERICA MANUFACTURE AND DEVELOPMENT: **OTIS ENGINEERING CORPORATION**, POST OFFICE BOX 7206, DALLAS, TEXAS, U. S. A.

Tubing being elevated.

Method of make-up.

Plastic Tubing for Water Disposal Wells

A RECENT installation of a complete string (3387 ft) of all plastic tubing in a salt water disposal well on the Harbecek lease of National Cooperative Refinery Association in Western Kansas* is indicative of the extent to which light weight, low tensile materials of non-corrosive composition may be utilized.

This type of all plastic pipe was first applied in the oil industry in April, 1949, in fields in Kansas, Illinois, Oklahoma, and Texas as a material suitable for use in low pressure transmission lines handling sour crude, paraffin crudes, raw gas, fresh and brine waters. It is unaffected usually by dilute acids and alkalies, and organics (with the general exception of chlorinated solvents and aromatic hydrocarbons), and it is unaffected by corrosive soil conditions. It forms a leakproof line, is installed easily and rapidly, hence is a suitable material for certain lead, flow, or disposal lines on producing properties where corrosion, either internal or external, or solid depositions are a factor. Records covering five years service on some low pressure gas lines indicate no apparent deterioration.

*By the Green Contracting and Engineering Company, Inc., Wichita, Kansas.

The basic material† in this pipe is a special grade of cellulose acetate butyrate, selected for maximum impact and tensile strength and satisfactory aging qualities. It is compounded further at the time of extrusion to form a semi-rigid, tough, high tensile, non-corrosive product with the following physical properties. (Table 1).

The materials are suitable for a working temperature range of — 40 F to 140 F, although it may be noted from Table 1 that impact strength is reduced materially at low temperatures; and that tensile strength is decreased as the temperature increases.

Line Pipe

Experience has shown that plastic line pipe can be strung, made up, and placed in a ditch in much the same manner as steel pipe. Actual stringing and make-up time with a three-man connection gang ranged from 1200 to 1500 ft per hr on a 3-in. line. In most instances, the line should be buried; however, no special grade is required under average soil conditions, and special precautions need not be taken in back-filling, for its flexibility permits the pipe to follow the contour of the earth. In rocky terrain or on deep cuts, however, care should be exercised to protect the pipe from fractures; and at road or lease crossings where heavy traffic is contemplated, the pipe should be run in conduit. A

†Designated as Carlon "B."

TABLE 1. Physical properties of plastic pipe material.*

Specific gravity 1.18, ±5 per cent.
Impact strength IZOD ft—lb. per in. notched.
—40 F 0.5
77 F 1.2
Tensile strength at 77 F 4400 psi
158 F 3000 psi
Tensile at first signs of stretch,
77 F 3000 psi
Flexural strength at yield, 4800 psi 77 F.
Compressive strength at yield, 3600 psi 77 F.
Thermal expansion (avg) 6.1-9.4x10^5 in. per deg. F.
Burning rate, slow.
Water absorption, 24 hr per ⅛ in.—1 to 2 per cent.
Modulus of elasticity, 2x10^5 psi (tension).
Sunlight resistance—Excellent.
Dielectric strength—400 v per mil ⅛ in. thickness.

*Carlon "B"

Plastic Pipe Data

Size	Approx. wt., lb. per ft.	Nom. ID, in.	Nom. OD, in.	Calculated burst pressure, psi
2 in. line pipe.....	.45	2.00	2.25	550
3 in. line pipe.....	.63	3.00	3.25	300
4 in. line pipe.....	1.01	4.00	4.30	300
5 in. line pipe.....	1.60	5.00	5.36	375
6 in. line pipe.....	2.35	6.00	6.46	300
2 in. threaded tubing	.672	2.00	2.37	900
2½ in thread. tub..	.826	2.50	2.87	900
3 in. threaded tubing	1.33	3.00	3.50	600
4 in. threaded tubing	2.44	4.00	4.67	600

Of course, no operator tries anything so absurd. But lack of *accurate* down-the-hole information can be as bad as a blindfold. So—to "pin point" their completion programs, operators in every oil area in the nation rely on Lane-Wells Radioactivity Well Logging.

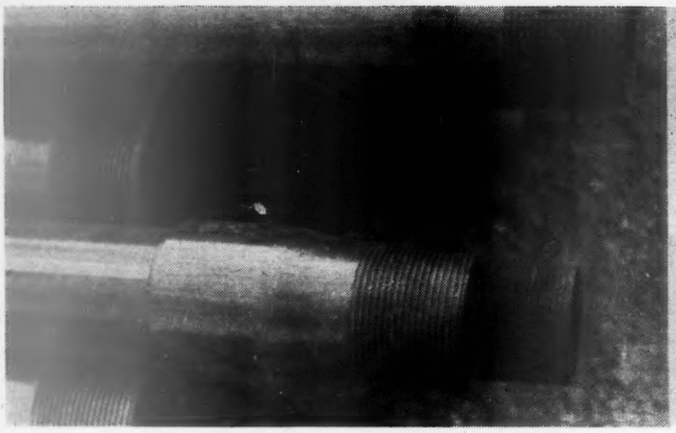
Reason #1: Radioactivity Well Logging provides the *only* complete record possible through casing. Reason #2: In either open or cased hole, Radioactivity Well Logging accurately determines formation depths, thicknesses, and characteristics; locates zones of porosity; marks fluid levels, casing seats and liner overlaps, and gathers other information. Reason #3: Radioactivity Well Logging ties all this invaluable information together with a log of casing collars, thus providing a series of fixed, immovable bench marks for all future down-the-hole work.

If you're now using Radioactivity Well Logging, you know all this. If not, why not find out what Radioactivity Well Logging can do for you—it's easy—just call

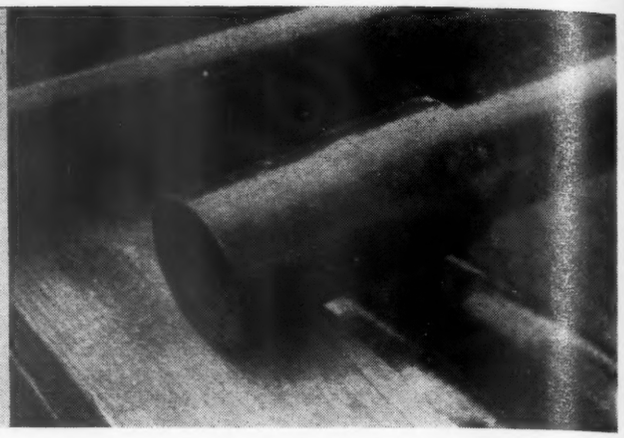
Radioactivity Well Logging by

LOS ANGELES - HOUSTON - OKLAHOMA CITY
General Offices, Export Offices & Plant
5610 So. Soto St., Los Angeles 11, California

LANE WELLS COMPANY



Threaded female adapter.



Threaded male adapter.

leakproof joint is facilitated by the use of a slip sleeve coupling that comes cemented to one end of the pipe and into which the male end of the next joint is inserted after being coated with a cold weld plastic cement that welds the sleeve and the pipe into one integral unit. The speed and ease with which make-up can be made, along with length of joint (avg 20-ft) and its extreme lightness, accounts to a large extent for the unusually large amount of line that can be handled per hour. Standard threaded adapters for going from plastic to steel connections are available and may be run up with standard pipe wrenches.

Tubing

The extra heavy plastic tubing combines all the chemical and physical properties of the plastic line pipe. It has upset male and female adapters and standard length threads. It can be handled with standard tools (slips, elevators, and chain tongs); hence there is very little difference in running this tubing instead of steel tubing. Experience indicates, however, that care should be exercised to prevent cross threading due to the gasket-like characteristic of the material. Due to its extreme light weight and semi-buoyancy in brine, heavy service equipment is not necessary. As an example, the string that was run in the Harbecek well weighed only one and one-half tons, whereas a comparable string of 3-in. cement-lined steel tubing with comparable capacity would have weighed about 17 tons.

The manufacture of plastic pipe in an extruded seamless form, particularly on sizes larger than 2-in. is a relatively new technique that results in a finished product with tolerances comparable to steel. Although it necessaril embodies the use of standard extrusion equipment and base raw materials used in the extrusion of thousands of commercial items of every description, the manufacturing process is as exacting and more complicated than blowing glass. The manufacturing process is described as follows:

First, the plastic compounds, in pellet, powder, granular and strip form are dehydrated in controlled material dryers. They are then placed in the feed hoppers on the extrusion machine and are conveyed from there into and through the heating cylinders where they are heated or melted to the proper temperature. The plastic is then extruded at high pressures through the forming die or head into the size and shape desired; then, as it comes out of the extrusion head and over the conveyors, it is "normalized" and cooled. This latter operation, particularly with regard to difficult or large shapes, requires the real "know-how" and rigid control.

Although the manufacture of plastic pipe is expensive at present, it is reasonable to assume that the cost per foot will decrease as the demand increases. ***

Gist
POSITIVE CASING CENTRALIZERS
Simplify
the art of good cementing
Get Better . . . faster cementing jobs without risk of channeling or damage to mud-cake. Thousands of Gist centralizers are in use throughout the oil country today. They are the simplest, most positive devices ever developed for centering casing in a bore. Great flexibility of application and usage overcomes most centering problems. Saves time . . . saves money . . . simplifies the art of good cementing! Investigate TODAY!
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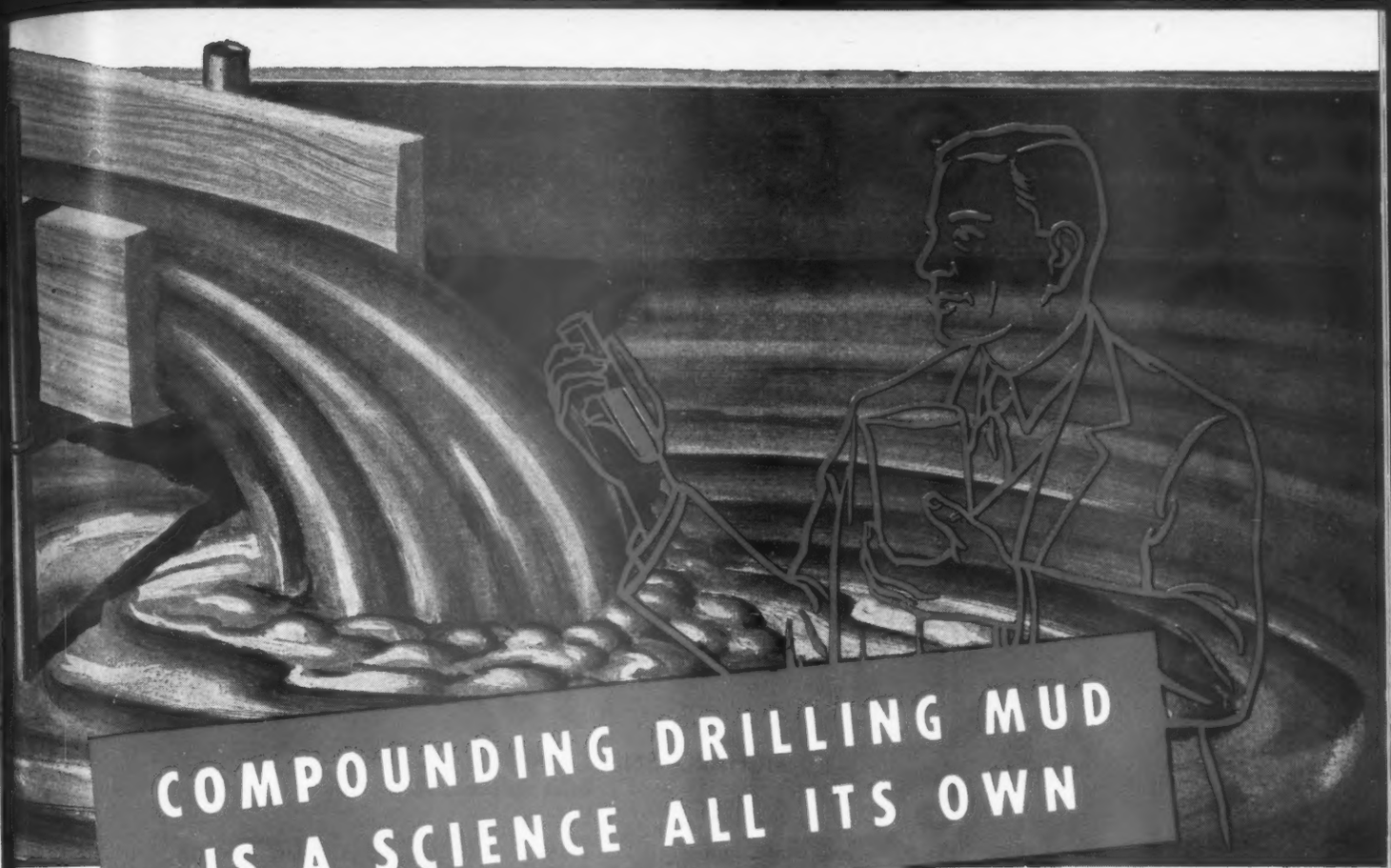


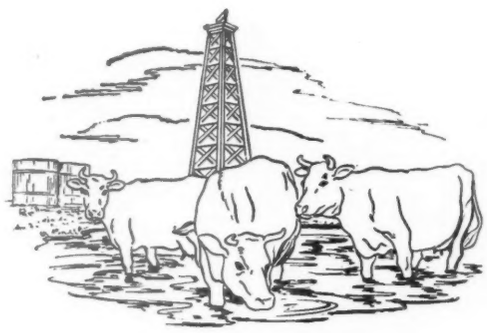
COMPOUNDING DRILLING MUD IS A SCIENCE ALL ITS OWN

Through chemistry, modern drilling muds that throb through flow lines and play such a vital role in today's deep, high pressure oil wells have evolved into a complex, specialized science all their own.

As an example, the carefully compounded and controlled drilling muds used in deep Gulf Coast wells today are a far cry from the earth-and-water muds used in early discovery wells that established the Gulf Coast region as one of the world's most prolific, high pressure oil producing areas.

History records . . . and many an old-timer is still around to confirm it . . . that mud used in the Spindletop well was actually siphoned from a near-by mud hole, agitated by cows wallowing and tramping through the mire.

Drilling muds and chemicals have become an increasingly important part of the drilling operation. Drilling muds and chemicals to meet the multitude of problems encountered in today's deep, high pressure wells are developed in modern laboratories by skilled chemists. Each new chemical . . . each new refinement to drilling muds . . . is developed only after exhaustive research and tests.



Magcobar has met this challenge by providing the oil industry with a complete drilling mud and chemical service. This includes modern laboratories and skilled personnel for product development and quality control, and capable field engineers in laboratory-equipped cars with two-way radio to give prompt assistance at the rig.

Yes, through chemistry, modern drilling muds have progressed far beyond the earth-and-water stage. Look for the Magcobar sign when you need mud. There are more than 250 Magcobar dealers from Canada to Florida who are ready to serve you night and day with complete drilling mud service.

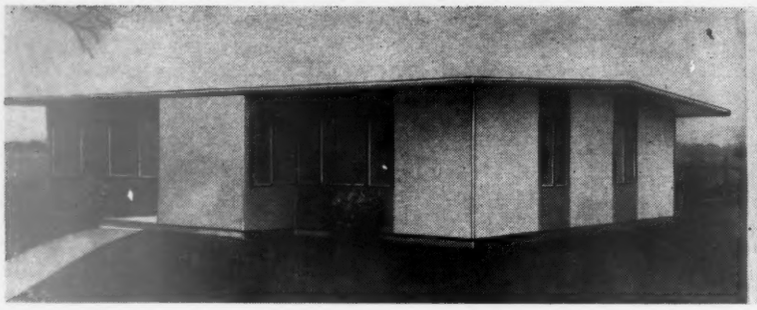
MAGNET COVE BARIUM CORPORATION, Malvern, Arkansas; Houston, Texas

Export Representative: Daniels, Beckley and Associates, 30 Rockefeller Plaza, New York 20, New York.

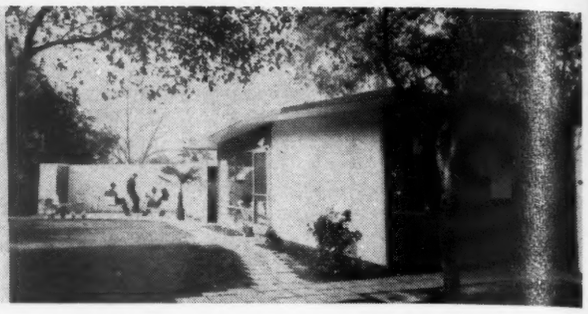
Look for this sign WHEN YOU NEED MUD

MAGCOBAR • MAGCOGEL • HIGH YIELD DRILLING MUD • XACT CLAY • FIBER-SEAL • MAGCO-MICA • TANNATHIN • JEL-OIL MUD • JEL-OIL "E" • SALT GEL • NOHEEV • SEAL FLAKES • MY-LO-JEL • CHEMICALS

Magcobar
Complete
DRILLING MUD SERVICE
DEALER



Completed house needs 400 man hours for erection.



Finished aluminum house landscaped.

Pre-Fab Houses in Foreign Operations

RICHARD SNEDDON*

OF major consideration these days is housing for American personnel in foreign fields. It has definitely become a high priority problem for those petroleum operators that have interests in remote areas of other lands. It requires no deep thinking to deduce that when an administrative officer is taken out of his normal social and industrial habitat and is transferred to some isloated and completely unfamiliar territory, his functioning is to a marked extent affected by the comfort and convenience of his new surroundings.

For these and other reasons, much attention is at the moment being given to the matter of housing for administrative and supervisorial personnel; manufacturers are devoting themselves to the design and construction of dwellings that will meet the requirements of strange and rigorous environments; and that "camping out" feeling is gradually being driven from the minds of the transferees by a satisfying sense of security and stability.

The following factual data are derived from the recent studies and experiences of a California organization† that has investigated every angle of the foreign housing situation and has designed and built many pre-fabricated structures especially to meet both the practical and esthetic needs in various isolated sections of the world.

The considerations involved in such a housing program are at once numerous and complex. For example, even the simple matter of crating material is important enough to demand logical treatment. Apart from the necessity of packing the pre-fab units in orderly arrangement and properly identifying them, so that when they arrive at their destination the assembly can be contrived successfully and expeditiously, there is the somewhat extraneous necessity of making the crates themselves of some material that will be of worthwhile use, particularly when the houses are to be erected in remote, barren, and unpopulated areas. Transportation to and from foreign fields is difficult and expensive, and this utilization of "everything but the squeal" is economical operation at its best.

In the choice of building materials there is further effort to facilitate handling, to reduce costs, and to expedite the erection and dismantling processes. When transportation is involved, lightness and compactness are highly desirable in the finished package, and the organization here concerned has employed a primary building material that lends itself admirably to these purposes. It consists of a phenolic resin impregnated paper core, bonded between two aluminum alloy sheets and sealed. This yields a product with an unusually high "strength-weight" ratio, well adapted to the building of portable homes.

The basic structural material, although comparatively new to the building industry, has already been thoroughly tested by the aviation industry. It has been found that the impregnated core, despite its lightness, has remarkable strength characteristics. When properly and permanently adhered to the faces it develops a material of such unit strength, indeed, that no framing is necessary. Interesting too, is the fact that the honeycomb paper core is an ideal insulating material. It is equally adapted to the refraction of heat in tropical areas, to the retention of heat in frigid zones, and is virtually soundproof. Advantages of the aluminum faced building material are that it will not rust or absorb moisture, is immune to the attack of termites or other insects, will not shrink in dry desert climates or swell in damp, cold climates. It is more fire-resistant than the usual wood type construction, needs less protection, and its components are in plentiful supply. In all respects it seems to be ideally suited to the building of oil field homes in foreign territories and in domestic territories also, and actual experience to the moment seems to give ample support to this conclusion.

From this type of material have been fashioned two and three bedroom homes that are thoroughly modern. With slight changes, either of the houses may be adapted for use as a field office, recreation building, laboratory, or change house, and the only extraneous requirement is a concrete foundation slab. The structure can be assembled with the minimum of labor and no especially trained personnel are required for the job. Every essential of a complete home is included, down to the soap in the bathroom. Aluminum or steel windows are optional, and the package includes a fac-

*Pacific Coast Editor.
†Key Contractors, Inc.

EXCLUSIVE

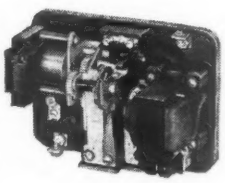
The 16 G-E Tri-Clad motors driving these water-injection pumps, like all others of famous Tri-Clad construction, are triply protected against operating wear and tear, electrical breakdown, and physical damage.

YOU CAN'T BEAT THESE G-E PUMP MOTORS

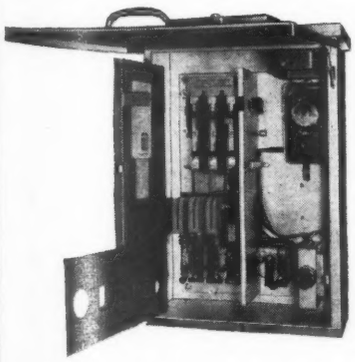
—for easy maintenance!

Another example of General Electric oil field electrification!

G-E pressure switch trips starter if pressure is too low or too high, protects pumps against suction-pressure loss.



With a **G-E** time-delay relay, pump motors are not started all at once, but in succession, to prevent excessive voltage drop.



Ventilated **G-E starters** for individual pumps combine cycling time switch, motor-circuit switch, magnetic full-voltage starter, and both lightning and overload protection. Double-door, dead-front enclosure permits easy access.

In this case, to obtain the full benefits of electrification for his oil lease, an Eastern operator wanted pump motors that would give really reliable service, need only minimum maintenance. That's just what he got—16 General Electric Tri-Clad induction motors, each rated 50 hp, to drive a battery of reciprocating pumps in a water-injection station. These motors can run safely without lubrication for years, and if lubrication is needed, it's grease-gun easy, with no need to disassemble the bearings.

In secondary recovery, as in all phases of oil field operation, electrification can help you lengthen the profitable life of wells, increase their ultimate yield. With electric well-pumping, too, you can expect lower power costs, automatic control that relieves men for other duties, and reduced maintenance. The whole story is told in Bulletin GES-3485, "More Oil at Less Cost—Electrically." Let us send you a copy. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

SEE THE LATEST IN MODERN RECOVERY METHODS!

You'll find plenty of helpful information and ideas in "Lease on the Future," General Electric's full-color and sound motion picture on oil field electrification. A half-hour film, it brings you up to date on electric well-pumping, shows how you can boost well yield at low cost—electrically. To arrange a showing, just pick up the phone and call your nearest G-E office.

More Power to America

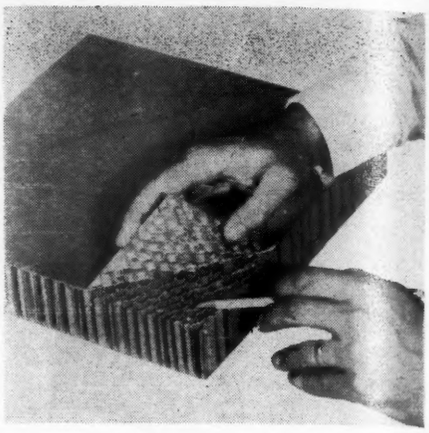
GENERAL ELECTRIC

661-3

tory made plumbing unit assembly for kitchen and bathroom. The only field plumbing work necessary is the installation of the fixtures. Copper tubing is used throughout, and bathtub, sink, automatic heater, all expertly fitted into the general scheme, are a part of the total package. The house can be assembled completely in 400 man hours, which includes the time required to pour concrete, install wiring, and perform all essential operations. The two-bedroom house has 16 convenient double electrical outlets; the three bedroom unit has 21.

When completely set up, the prefabricated home has a total floor space of some 1035 sq ft (the 3-bedroom unit). It has a very pleasing as well as convenient architectural arrangement, and meets all the modern concepts of the conservation of housework motion; ample cupboard space and easy accessibility; adequate interior lighting and plenty of sunlight; and finally is so designed as to present a pleasing patio-garden effect that should help to combat nostalgia, and enable the tenant to settle more quickly and comfortably into his new life.

Some of the technical specifications may be of interest. Design conditions include the following: (1) The house shall be designed to sustain a vertical loading of 20 pounds per square foot on the roof, acting either up or down, without exceeding the safe wearing stresses specified for the building materials. (2) The house shall be designed to sustain a wind loading of 15 pounds per square foot on the walls and projected roof area, without exceeding the safe working stresses as above. (3) The house shall be designed to resist an overturning moment, as calculated from the live wind load, which shall not exceed ⅔ of the dead load resisting moment. The weight of the three-bedroom home is 6 tons, and for the two-bedroom unit is 5½ tons, that is when crated, and complete with all fixtures and accessories. Total floor space, as already indicated, in the three-bedroom unit is 1035 square feet, and for the two-bedroom unit is 810 square feet.

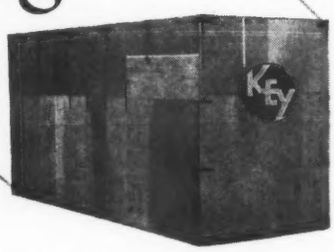


Cutaway section of the aluminum panel showing cellular insulation. Note how material is bonded to aluminum.

At the present time there is a widespread interest in foreign oil operations, and we may be sure that as soon as this interest blossoms into activity, the housing problem will at once assert itself. This business of furnishing comfortable housing that is sufficiently light to be transported and transferred at will, and sufficiently strong to be resistant to all the elements, is a highly specialized enterprise. It was found that inadequately housed workers are not good producers, and that, similarly, inadequately housed administrators are not good administrators. The manufacturing program sketched here is one of the results of these disclosures. It embodies the thinking and experience of experts, and it has developed a portable home that should prove very useful to an industry which is always mobile, whether it operates at home or abroad. * * *

Gracious Living...

PACKAGED FOR EXPORT



Personnel of Companies Operating In Foreign Fields Now Given Chance To Live In New Comfort...

No longer is it necessary for company personnel to live in clapboard shacks or depend on foreign housing. Key Contractors offers this smart, modern, insulated aluminum house especially designed for export and tropical use.

Each house is complete in every detail, right down to the doorbell and soap dish in the bath. After Key is finished only the utilities need be connected and personal furniture moved in to make this charming house a completely livable home.

Complete 3-bedroom house shown above may be packaged in 8' x 10' x 22' crate, weight approximately 16,000 pounds, to be shipped and erected anywhere in the world.

Look At These Features...

- Fixed and casement type steel sashes, fully glazed.
- Vermin and insect proof.
- Low cost maintenance.
- Large wardrobes and cabinets.
- Easy to disassemble and move to another location.

Here's How KEY Does It...

Each house is completely erected to double check each part before crating. All skilled work such as plumbing and wiring is done before the house is shipped. The house is erected upon arrival on concrete slab by local labor under Key supervision in approximately 400 man hours.

KEY CONTRACTORS, INC.

Phone: Whittier 44637 • P. O. Box 356, Santa Fe Springs, Calif.

MAIL THIS COUPON FOR MORE DETAILS

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

Here's GROVE Air Dome Dependability—*in well head protection*

...the GROVE Model 390 Automatic Shut-Off Systems

For dependable protection against dangerous well head conditions, install the Grove Model 390 Systems, designed for automatic shut-off in the event of line breakage, freezing or failure of other equipment. Universal in pressure range, any Model 390 System can be preset for overpressure or underpressure shut-off from 50 to 6000 p.s.i., and will operate as often as needed—ten times a day or once in a lifetime. Resetting can be manual or automatic; adjustment changes or testing require no main line bypass and are quickly and easily accomplished without removal from the line.

Both main and pilot valves contain large powerful diaphragms, and utilize the patented Grove Air Dome principle. There are no springs to set—the Grove Air Loading feature makes setting as easy as reading a gauge. Elimination of pistons and piston packing gives a dead tight seal with no chance of corrosion or sticking.

The outstanding qualities of the Grove Air Dome design have been proved in over a quarter-million installations. Now, for Well Head Protection, Grove offers the safest, surest shut-off available. To prevent waste—to safeguard expensive equipment—and to cut down maintenance, contact the nearest Grove office today . . . ask for full details on the Model 390 Well Head Protection Systems.

GROVE REGULATOR COMPANY
65th & Hollis Street, Oakland 8, California

3608 Navigation Blvd., Houston, Texas
310 Thompson Bldg., Tulsa 3, Oklahoma
1930 W. Olympic Blvd., Los Angeles 6, California
205 E. 69th Street, New York 21, New York

GROVE — GROVE "PUTS PRESSURE TO WORK" — MODEL 390 WELL HEAD PROTECTION SYSTEMS

NEWS

Make 1950 Drilling Plans

Operating unit of the Chilean Government, Corporacion de Fomento, has completed 12 wells in the Manatiales field in Southern Chile. Three wells are now drilling. Commercial production of the field awaits the completion in 1950 of a line from Spring Hill to Bahia Blanca now under construction.

Complete Third Producer In Jose Ruiz Concession

Pancoastal Oil Company, C. A., and Venezuelan Atlantic Refining Company have completed their third producer in the Jose Ruiz concession in Eastern Venezuela. On a test, the new well flowed at the rate of 660 bbl daily, according to Florent H. Bailly, Pancoastal president.

Production was 248 bbl of 36 gravity oil from the upper horizon, and 412 bbl of 28.2 gravity oil from the lower.

Three Companies Enter Operating Agreement

Union Oil Company, Signal Oil and Gas Company, and Hancock Oil Company of California have entered into an operating agreement for development of approximately 1,700,000 acres currently held by Union Oil Company in the state of North Dakota.

The principal areas under lease are in the counties of Towner, Cavalier, and Ramsey in North Dakota. The total area to be exploited covers the state of North Dakota and the east half of South Dakota. The acquisition period is for five years. Union Oil Company will be the operator.

Offer New Plastic Map

A big, colorful relief map of Venezuela—in lightweight plastic has been produced by Aero Service Corporation of Philadelphia, Pennsylvania, for Creole Petroleum Corporation. One thousand of the maps will be distributed in Venezuela by the oil company as part of its broad public relations program. The maps will be presented to Venezuelan schools, colleges, government offices, libraries, banks, and similar institutions.

This map is based on a compilation of the American Geographical Society. Thirteen map sections were re-compiled, edited and re-styled for relief presentation by Aero Service Corporation. The map's scale is 1:1,250,000; its vertical exaggeration is 5 to 1. It covers an area of approximately 800,000 sq miles. Copies of the map may be purchased from the manufacturer, Aero Service Corporation, Philadelphia, Pennsylvania.

Officers of American Association of Oilwell Drilling Contractors

New officers of the American Association of Oilwell Drilling Contractors: First Row: Ralph W. Marshall, Drilling and Exploration Company, Inc., Los Angeles, California, vice president for California; Joseph S. Morris, Allen and Morris, San Antonio, Texas, retiring president; Warren S. Churchill, Arrow Drilling Company, Dallas, Texas, incoming president; Joseph V. Dunbar, Dunbar Drilling Company, Salem, Illinois, vice president at large; Louis A. Beecherl, McDaniel and Beecherl Drilling, Dallas, treasurer.

Second Row: J. F. Postelle, Odessa, Texas, vice president for West Texas and New Mexico; Zach K. Brinkerhoff, Jr., Brinkerhoff Drilling, Casper, Wyoming, vice president for Rocky Mountains; H. L. Rowley, Big Chief Drilling, Mississippi, vice president for Cretaceous and Tertiary Basins; J. Doyle Settle, A.A.O.D.C., Dallas, secretary; Marion S. Church, Dallas, general counsel.

Third Row: Brad Mills, A.A.O.D.C., Dallas, executive vice president; R. W. Wire, Loffland Brothers, Tulsa, Oklahoma, vice president for Central Mid-Continent; Ira Van Tuyl, V-T Drilling Company, Evansville, Indiana, vice president for Illinois, Michigan, Indiana, and Kentucky; Roger J. Wolfe, Grey Wolf Drilling, Houston, Texas, vice president for Gulf Coast.

Not present at meeting were J. A. Fox, Washington, Pennsylvania, vice president for Cable Tools, and J. J. Harrigan, Standard Well Service Company, Oklahoma City, Oklahoma, vice president for well servicing.

Shell and Phillips Trade Oil-Producing Properties

In a move designed to improve the operating efficiency of both companies, the Shell Oil Company will exchange its oil producing properties in the Texas Panhandle for certain oil producing properties of the Phillips Petroleum Company in North Texas. The transfer that will involve approximately 750 bbl net production daily in each of the areas was announced jointly by H. S. M. Burns, president of Shell Oil Company, and K. S. Adams, president of Phillips Petroleum Company.

The transfer will not affect Shell's gas interests in Moore County but will involve the closing of Shell's district production office, Pampa, Texas.

The exchange of properties was brought about by the fact that Shell's production in the Panhandle was scattered and difficult to transport to that company's refineries due to the lack of adequate pipe line facilities. Through the transfer, Phillips, who has a concentration of operations in the Panhandle, gets some 750 bbl daily production in an area where they can more efficiently utilize it, and Shell has acquired like production in North Texas close to pipe line facilities which will transport it to its Wood River, Illinois, refinery.

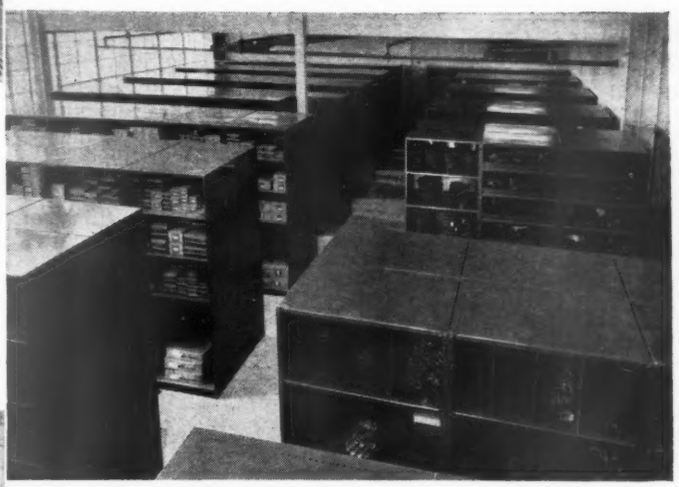
In making the announcement, the presidents of both companies pointed out that every effort will be made by each company to absorb its personnel affected by this change.

Plans Drilling in Australia

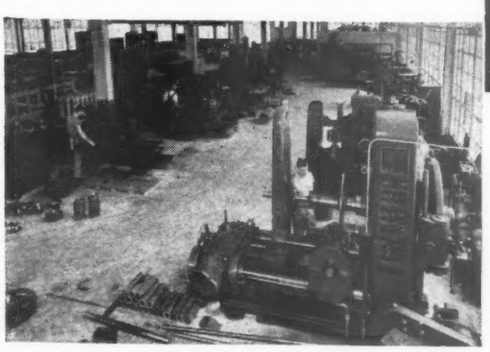
Prime Minister Joseph B. Chiefley of Australia, has been advised by The Shell Oil Company, that it plans to begin deep exploratory drilling to 10,000 ft, if necessary, near Rolleston in December. The company has been making an intensive search for oil in central Queensland.

Here's our New Houston Plant!

The new plant and office of Link-Belt Company, 3203 South Wayside, Houston, Texas, has been designed and built to better serve the ever expanding oil industry with conveying and mechanical power transmission machinery.



For your greater convenience, the Houston plant carries complete stocks of oil field chains and sprockets, bearings (both ball and roller type), and shale shakers, in addition to the stocks already carried in Dallas and Odessa.

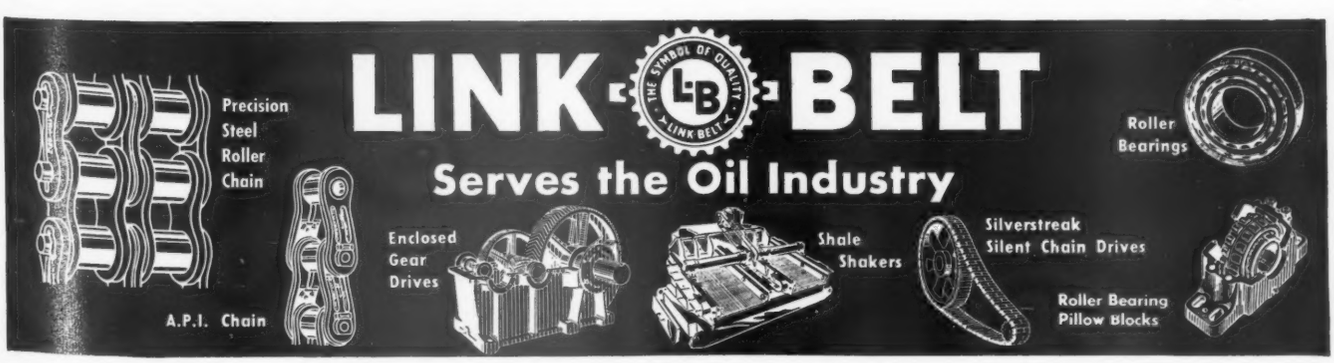


Features of the new plant are the machine and steel fabricating shops. These facilities, together with a large engineering department, enable Link-Belt to design and build special oil country equipment for you.

LINK-BELT COMPANY

Houston 1, Dallas 1, Indianapolis 6, New York 7, Los Angeles 33, Kansas City 6, Mo., Toronto 8.

11,648



NEWS

Geophysicists Hold Meeting in Dallas

A regional exploration meeting of the Society of Exploration Geophysicists will be held in Dallas, Texas November 17 and 18, 1949. The meeting is being sponsored jointly by the local geophysical societies of Dallas, Fort Worth, Tulsa, Oklahoma, and Shreveport, Louisiana. Registration will begin at 8:00 A.M. Thursday, November 17.

A diversified program of papers will be presented of which about 50 per cent will treat limestone reefs and allied subjects, including both geological and geophysical papers. Of the remaining papers, approximately half will be case histories and the rest will concern instrumentation and techniques. A program of the papers to be presented will be mailed out in advance of the meeting.

There will be a luncheon for all at noon November 17. Special groups may make arrangements for luncheons at noon on November 18 by contacting A. E. McKay, Atlantic Refining Company, Magnolia Bldg., Dallas, Texas. A reception and dinner-dance will be held at the Adolphus Hotel, Friday evening, November 18.

Headquarters for the meeting will be the Adolphus Hotel, where one hundred rooms are being reserved.

Acquires Long-Term Leases

Lion Oil Company has acquired leases on more than 500,000 acres of land in North Dakota. The "Devonian formations, which produce in Alberta, extend through Saskatchewan and into North Dakota," T. M. Martin, president, Lion Oil, has stated.

According to Martin, only a few 'wildcat' wells have been drilled in North Dakota, of which only two can be considered adequate tests of the area in which they were drilled. These conditions resulted in decisions, arrived at by several oil companies operating independently, to enter into active exploration compaigns intended to develop oil and gas production in North Dakota.

New Kansas Pool

A new pool is believed to be opened with the discovery of Atlantic Refining Company's Hoffman No. 1 in northeastern Rice County, Kansas. In preliminary tests the well averaged four bbl of oil hourly from the Lansing lime through perforations at 3092-98 ft, after acid treatment. The well is estimated to be good for 25 to 30 bbl a day.

Texas Tidelands Discovery

The first marine-drilled discovery in the Texas tidelands has been made by Stanolind, Melben, and Ohio Oil.

The well is the Stanolind-Ohio-Melben No. 1 State, tract 31,700, off Galveston Island. It flowed at the rate of 5,122,000 cu ft of gas daily through a 5/16-in. choke plus 48.6 bbl of 54 gravity condensate from 5934 to 5958 ft. The well is now shut in.

Carter Has Oil Potentials

Carter Oil Company is testing in a new Viola lime pool in Kansas, where potential has been taken on another producer in the Davis Ranch field of Wabaunsee County.

Carter's No. 1-B Davis, extending the pool to the south, made a state productivity test of 6005 bbl of oil in 24 hours on the pump. Viola lime was perforated at 3188-98 ft. Gravity is 29.9 deg.

Begin Exploratory Program

Royalite Oil Company has begun the first intensive exploratory campaign ever conducted in the Queen Charlotte Islands, off the British Columbia Coast. Until recently, exploratory drilling in the province has been limited primarily to the Peace River, Flathead Valley, and Fraser River Delta areas. Royalite has been assigned 230,000 acres on Graham Island for exploratory purposes.

Photography Aids Geologists

Aerial photographic techniques for analyzing earthquakes and earthquake damage are described in a geological report recently issued by Far East Command Headquarters, concerning the Fukui earthquake of June, 1948 in the Japanese island of Honshu. Immediately following the quake, low-flying reconnaisance planes blanketed the affected region with aerial photographs, which aided geologists and rescue workers who entered the area the following day.

The aerial photographs were used to determine the amount of damage to man-made structures, as well as to evaluate geological changes in the area. Although aerial photos have been used extensively by geologists in recent years to locate oil fields and to study terrain, this is the first recorded instance of their use in connection with modern earthquake studies.

New Offices Opened

Offices have been opened in Tulsa, Oklahoma by Ken R. Burns, Petroleum and Geological Engineer. The company formed will undertake the development of oil properties.

General offices have been established in the Atlas Life Building in Tulsa. A district office will be maintained at Wichita Falls, Texas in the Panhandle Building. The company will also offer engineering and technical services on a consulting basis.

Sinclair explored its Ethiopia concession and began its first well. Emperor Salessia and his party inspect a camp site here with Walter J. Wells, field superintendent. The Emperor's dog accompanies him everywhere.

Imagine TWO Hydraulic Gates—13⅝" bore

*in only 30" total cellar height!**

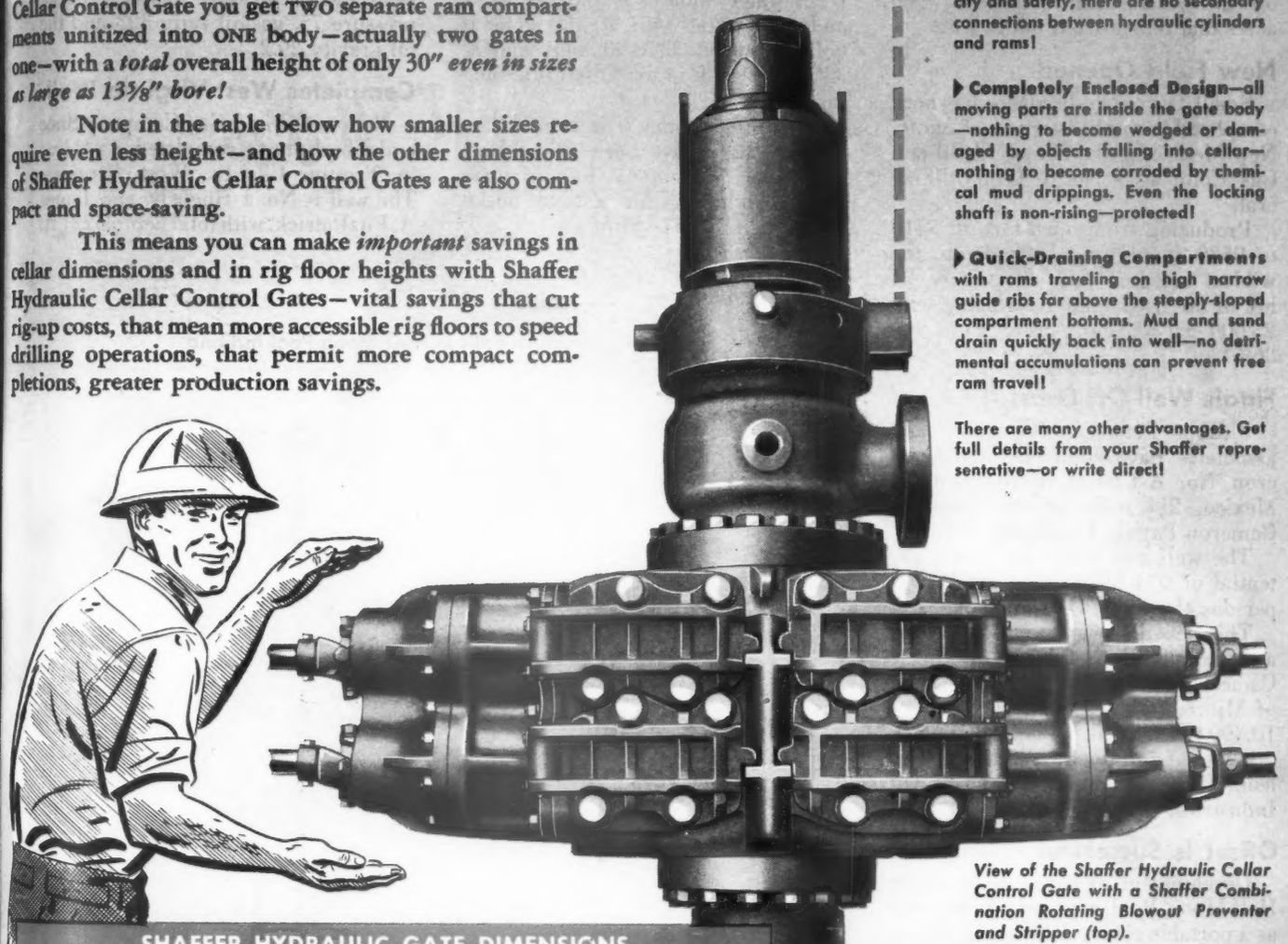
that's what you get in the NEW

SHAFFER Hydraulic CELLAR CONTROL GATE!

That's right—in the new Shaffer Hydraulic Cellar Control Gate you get TWO separate ram compartments unitized into ONE body—actually two gates in one—with a *total* overall height of only 30" *even in sizes as large as 13⅝" bore!*

Note in the table below how smaller sizes require even less height—and how the other dimensions of Shaffer Hydraulic Cellar Control Gates are also compact and space-saving.

This means you can make *important* savings in cellar dimensions and in rig floor heights with Shaffer Hydraulic Cellar Control Gates—vital savings that cut rig-up costs, that mean more accessible rig floors to speed drilling operations, that permit more compact completions, greater production savings.



View of the Shaffer Hydraulic Cellar Control Gate with a Shaffer Combination Rotating Blowout Preventer and Stripper (top).

SHAFFER HYDRAULIC GATE DIMENSIONS

Gate Size	7"		9"		10¾"		13⅜"	
Working Pressure (PSI)	3,000	5,000	3,000	5,000	3,000	5,000	3,000	5,000
Bore	7 1/16"		9"		11"		13⅝"	
A—Height . . . inches	25	26½	25¼	27½	27½	30½	30	36¼
B—Width . . . . inches	28⅝	31½	31⅝	35¼	34¼	37⅝	40	40½
C—Length . . . inches	70¾	70¾	71	72	79	81¼	88½	88½

**Smaller sizes even less height!*

And space-saving compactness—important as it is—is only one of *many* far-reaching advancements incorporated into the new Shaffer Hydraulic Cellar Control Gates. Some of the others are outlined at right, but space does not permit telling the *complete* story on this great new cellar control gate. So before you buy *any* control gate equipment, be sure to get ALL the facts about the new Shaffer Hydraulic Cellar Control Gate. It's the outstanding buy in the field!

These and Other Unique Features Are Yours In The New SHAFFER HYDRAULIC CELLAR CONTROL GATE!

▶ **Simple Ram Changes**—the simplest in any gate. Merely unbolt and swing open a side door, slide out the ram assembly, slide in the new assembly, close and bolt the door. It's that simple—*and complete ram changes can be made whether pipe is in or out of the well!*

▶ **Direct Hydraulic Drive** with the hydraulic operating cylinders *directly behind* the rams. For maximum simplicity and safety, there are no secondary connections between hydraulic cylinders and rams!

▶ **Completely Enclosed Design**—all moving parts are inside the gate body—nothing to become wedged or damaged by objects falling into cellar—nothing to become corroded by chemical mud drippings. Even the locking shaft is non-rising—protected!

▶ **Quick-Draining Compartments** with rams traveling on high narrow guide ribs far above the steeply-sloped compartment bottoms. Mud and sand drain quickly back into well—no detrimental accumulations can prevent free ram travel!

There are many other advantages. Get full details from your Shaffer representative—or write direct!

Send for your free copy of the complete Shaffer Catalog.

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EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

26 years OF OIL TOOL LEADERSHIP

WHAT'S DOING IN DRILLING

Kentucky Wildcat Well

A wildcat well has been completed in Union County Kentucky by Sinclair Oil and Gas Company. The company's No. 1 Hite well tested to flow 240 bbl of 35 gravity crude oil in the first 24 hours. The well is producing from a depth of 2523 ft. It is situated on the west-central section of 900 acres that Sinclair has under lease.

New Field Opened

Small Devonian discovery has been completed in southeastern Lea County, New Mexico, at the Stanolind Oil and Gas Company's No. 1 Leonard-Federal.

Producing from open hole at 9410 to 9530 ft, plugged back depth, the wildcat rated a daily flowing of 24 bbl of 38 gravity after acidizing with 25,000 gal of acid. Gas-oil ratio was 868-1.

Finals Well Off Coast

Phillips Petroleum Company and associates have completed the Cameron No. A-1 well in the Gulf of Mexico, 2½ miles off the coast of Cameron Parish, Louisiana.

The well was completed for a potential of 934 bbl of 42.3 gravity oil per day through 14/64-in. choke.

This new discovery well, on Louisiana state block No. 33 of the West Cameron area, is producing from sand of Miocene age through perforations 10,390 to 10,408 ft. The well and block are owned jointly by Phillips Petroleum Company and Kerr-McGee Oil Industries, Inc.

Offset Is Successful

Development of a new field in the Half-Moon Pool area gets under way as a portable rotary drilling rig of Coy Oil Company, Evansville, Indiana, drills the firm's 2925-ft No. 1 Schmitzer in Posey County, Indiana, one mile west of Hoven. This well offsets the company's successful wildcat No. 1 Upshaw, drilled to 2760 ft and producing about 40 bbl daily from the O'Hara limestone.

The rig, one of two portable units built by Coy for its own operations, has a 94-ft mast. It has drilled 2000 ft of hole in seven days, working around-the-clock. Power is supplied by two diesel engines,* one on the draw works,† the other on the 7¼ x 10-in. slush pump.‡

*International UD-24.
†Wilson "Giant."
‡Gardner-Denver.

New Oil Field in Montana

Northern Ordnance, Inc., has completed a producer to open first major-size production in Montana this year, at its No. 1 Guertgen, nine miles southeast of Chinook, in Blaine County.

The well was drilled to the Madison lime at 3564-86 ft, to test a flow of hot fresh water; hole was plugged back and pipe set at 3461 ft. Pay zone is oolitic lime at 3378-90 and sand at 3390 to 3410 ft in the Ellis (Jurassic) formation.

Since first of the year to mid-September, there have been 28 wildcats completed in Montana, four of them being productive for a total initial production of 183 bbl of oil.

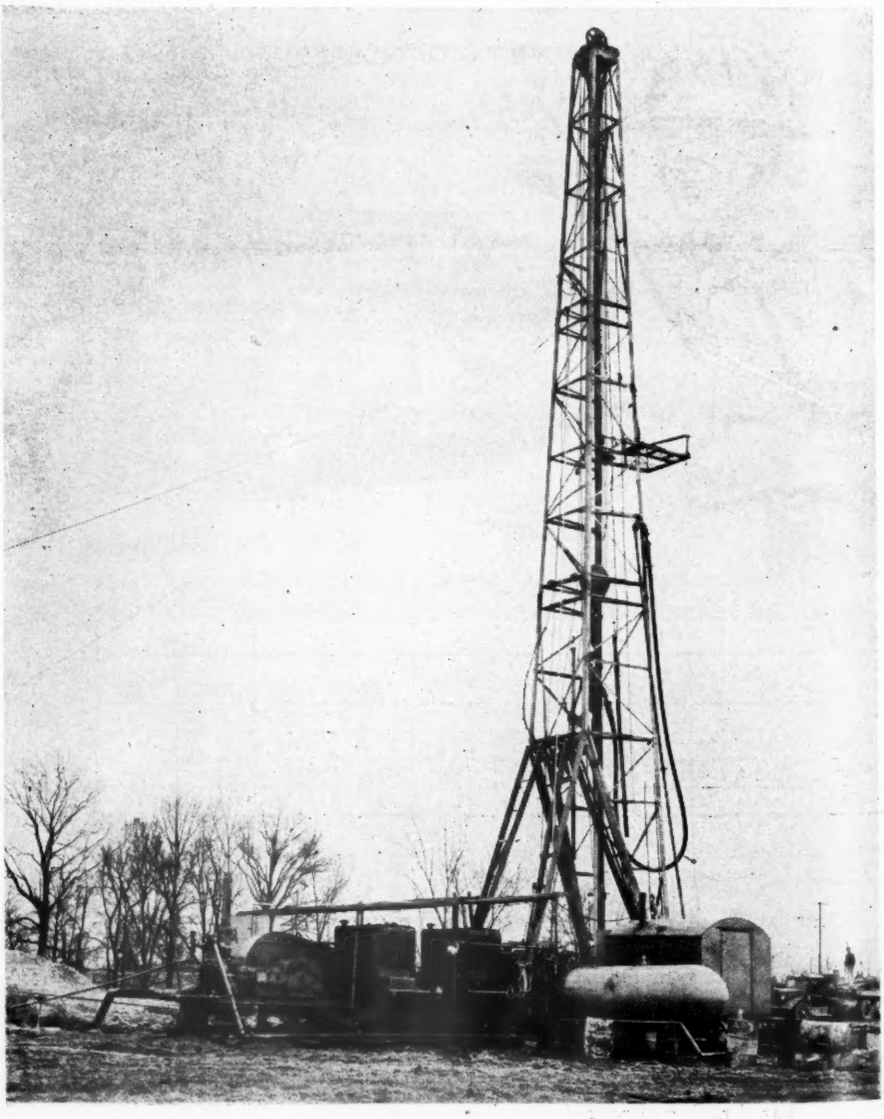
Producer in Velma Pool

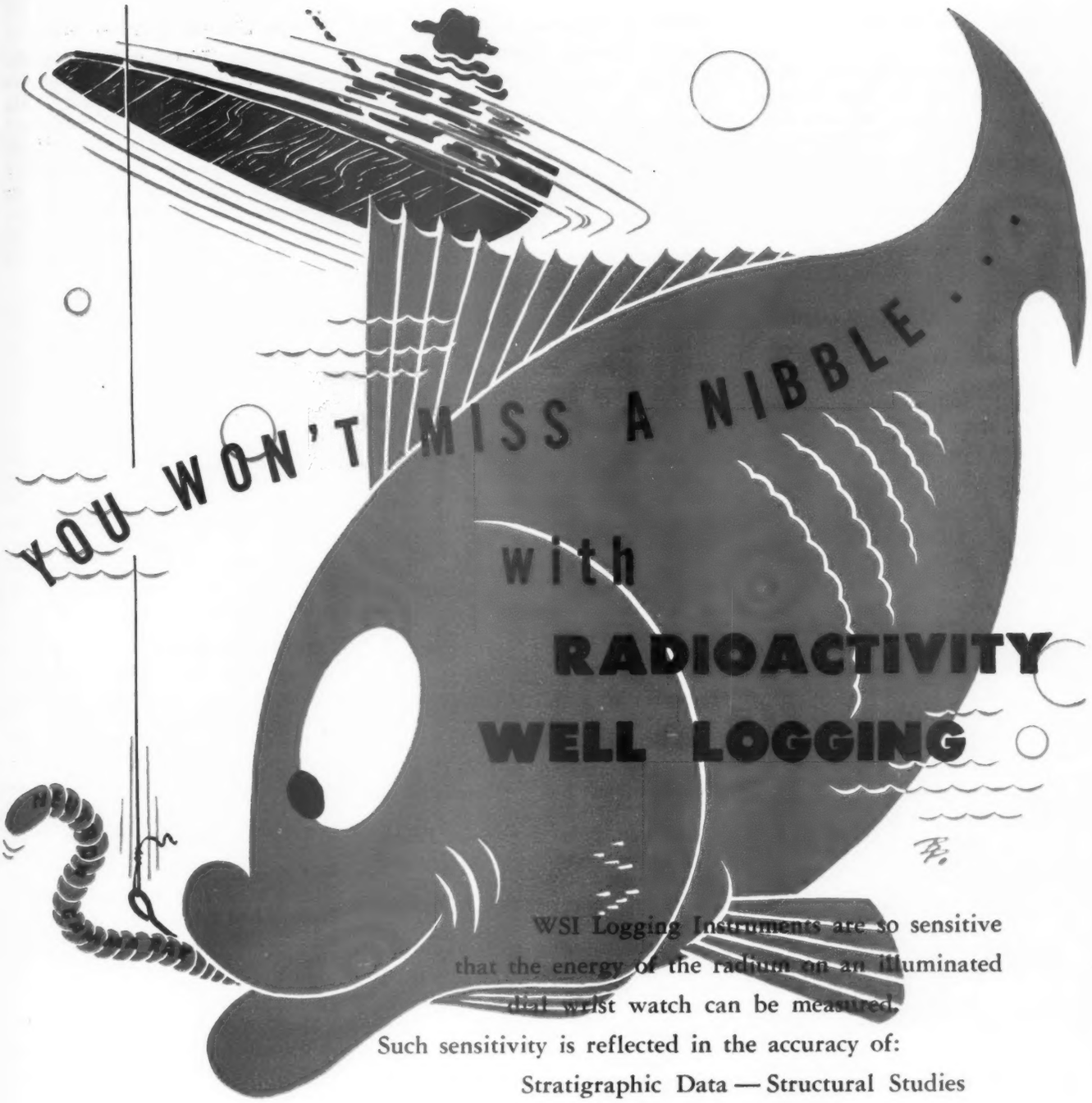
A new producer has been completed by Sinclair Oil and Gas Company in the Velma pool, Alma area of Stephens County, Oklahoma. It was the No. 1 H. R. Haines, total depth 6136 ft, that flowed 575 bbl in 14 hr through 2½-in. tubing in the Springer sand. Casing pressure was 499, tubing pressure 75, gas-oil ratio 323 and the oil gravity 29.2.

Completes West Virginia Well

Nollem Oil and Gas Company-Snee and Eberly have completed a wildcat in Preston County, West Virginia. The well is No. 1 Hugh R. and James A. FitzPatrick, with total depth 6221 ft.

Coy Oil Company drills in Half Moon Pool Indiana.
—Courtesy International Harvester.





WSI Logging Instruments are so sensitive that the energy of the radium on an illuminated dial wrist watch can be measured.

Such sensitivity is reflected in the accuracy of:

Stratigraphic Data — Structural Studies
Location of Zones of Porosity
Position of Radioactive Sands
Permeability Studies

Gamma Ray Curve, Neutron Curve and Collar Log can be obtained through several strings of casing.

Radioactivity well logging service is available from these experienced licensees. . . .

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LANE-WELLS COMPANY
UNITED STATES — CANADA

SEISMOGRAPH SERVICE CORP.
of Delaware
CARACAS, VENEZUELA

GEOTECNICA, S. A.
BUENOS AIRES, ARGENTINA

Complete Two Wells

Two other wells completed by Cities Service in Scurry County have established top initials for two Canyon Reef fields. Jolly No. 6 has been completed for an initial of 2429 bbl of oil daily through a ¾-in. choke. To date, this is the largest potential, by more than 400 bbl, of any well in the field. The well is producing from 311 ft of open hole, bottomed at 6847 ft.

The company's Pearson No. 2 in the Sharon Ridge field was finaled for an initial of 1639 bbl of oil daily through a ¾-in. choke. This too, is believed to be the highest initial registered for any Sharon Ridge well so far. This well is producing 43.6 gravity oil from 124 ft of open hole, bottomed at 6847 ft.

Sinclair Brings in Well

Sinclair Oil and Gas Company has brought in additional oil production from the Ellenberger formation on its acreage in the Shafter Lake oil field in Andrews County, Texas.

The company tested its No. 3 University No. 153 well located in the southwest corner of a 160-acre lease—north of previous Ellenberger oil production—to flow 1091 bbl of 41.3 gravity oil daily.

Longer Thread Life
WITH
Jimmie Gray
COMPOUNDS

EXCLUSIVE 500-TON SPECIAL

LONG-LIFE DRILL COLLAR COMPOUND

You can always break the joint when you use Jimmie Gray Compounds! That's because each one is engineered to do certain specified jobs best! You can depend on their thread-protecting film to prevent galling and washouts, too. Satisfaction is assured thru the famous Jimmie Gray money-back guarantee!

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FORMERLY STANDARD OIL SALES CO.

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CHarter 4-5648

Wells Completed in Scurry County, Texas

Cities Service Oil Company has given two northwest central Texas fields each a pair of good completions, in addition to a dual completion in the same area, for a total initial potential of 4500 bbl of oil for the five.

In the active North Snyder field of Scurry County, the company completed its Jolly No. 4 for a Texas Railroad Commission potential of 925 bbl daily, and its Jolly No. 5 for a potential of 1525 bbl.

In Gaines County, the West Seminole field showed company completions of the Proctor No. 7 for a 472 bbl potential and the Proctor No. 8 for a 281 bbl potential. Both are producing from the San Andres. The two wells are a joint venture of Cities Service Oil Company and Atlantic Refining Company.

In the Cowden F No. 1, the company found its second producer from the Clear Fork and Devonian horizons in the Dollarhide field of Andrews County. Completed dually, the well was given a potential of 1132 bbl from the Clear Fork and 215 bbl from the Devonian for a 1347 bbl total.

Test Kansas Wildcat

Field reports state an Ellis County, Kansas wildcat has recovered 300 ft of oil and 510 ft of heavily oil-cut mud.

The well, Nate Appleman, Derby Oil Company, and Veeder Supply and Development Company No. 1 Warren "A" is three miles south of the Berland field.

Reports, covering a 30-min drill-stem test said recovery was from Lansing rocks at 3442-66 ft.

Gauge Tidelands Well

Completion of a lower Miocene pay well, seven miles into the Gulf of Cameron Parish, Louisiana, has been reported by Stanolind Oil and Gas Company.

The well was drilled to 9044 ft. On drill stem test at 8823-28, it flowed at the rate of 447 bbl of 34.9-gravity oil daily. Ratio was 540 to 1. On later test, flow was 912 bbl through ¼-in. bottom and top chokes.

Ohio Wells Completed

Two good oil wells were completed recently in Knox County, Ohio.

C. D. Moore and others completed the No. 1 John Schooler in Clau township at a depth of 2859 ft. The well produced 40 bbl daily from the Clinton sand.

Sheffield Oil Company completed its No. 1 Earl Brich in Jackson township for 30 bbl daily from the Clinton sand at a depth of 3117 ft.

Finals Garvin County Well

Magnolia Petroleum has completed a good producer in the Southwest Antioch field of Garvin County, Oklahoma, where the No. 2 Stephens-C flowed an average of 32 bbl per hour.

From plug-back depth of 6853 ft and perforations at 6750 ft, the Stephens-C flowed 260 bbl of oil in eight hours through ½-in. choke. Gas-oil ratio on the 42.7-gravity crude was 1018 to 1.

Plans Further Drilling

Sinclair Oil Corporation has announced beginning of a 5-year $250,000,000 program to expand crude oil production.

The program will increase the company's crude oil production within the United States by 50,000 bbl a day within five years. Prior to recent cutbacks, Sinclair's output was 100,000 bbl daily.

New drilling will be in wildcat and semiproven areas, as well as in the producing fields.

Final Ohio Wells

Four wells have been completed within the past few weeks in Perry County, Ohio. The four wells have a combined daily initial of 480 bbl, and were finaled by Preston Oil Company, L. L. Dittoe and others, National Gas and Oil Corporation, Waverley Oil Works Company, Midland Oil.

Preston completed its H. C. Albert No. 2 in Hopewell township in the Clinton sand at a depth of 2954 ft. The well had a daily initial of 220 bbl.

L. L. Dittoe finaled its Swinehart-Albert No. 1 for 135 bbl daily. The well was completed in the Clinton at a depth of 2962 ft.

The P. Kelley No. 2 was completed by Waverly in Rush Creek Township, for 10 bbl daily in the Clinton at 2488 ft.

Midland Oil Company finaled the A. D. Cooperrider No. 4 in Bowling Green township, Licking County for 50 bbl and 200,000 cu ft of natural gas from the Clinton at 2907 ft.

Well Flows 808 Bbl in 12 Hours

Sinclair Oil and Gas Company and The Texas Company have completed their No. 1 McCoy-Holmes in the Golden Trend of McClain and Garvin Counties, Oklahoma. The well, in the Southwest Maysville pool of Garvin County, flowed 808 bbl of 42 gravity oil in 12 hours through ¾-in. choke on 2-in. tubing. Production is from the first Bromide sand, total depth 7615 ft.

With the oil was a flow of 1,619,000 cu ft of gas a day for a gas-oil ratio of 1001 to 1. Casing pressure was 1050 lb and tubing pressure 650 lb.

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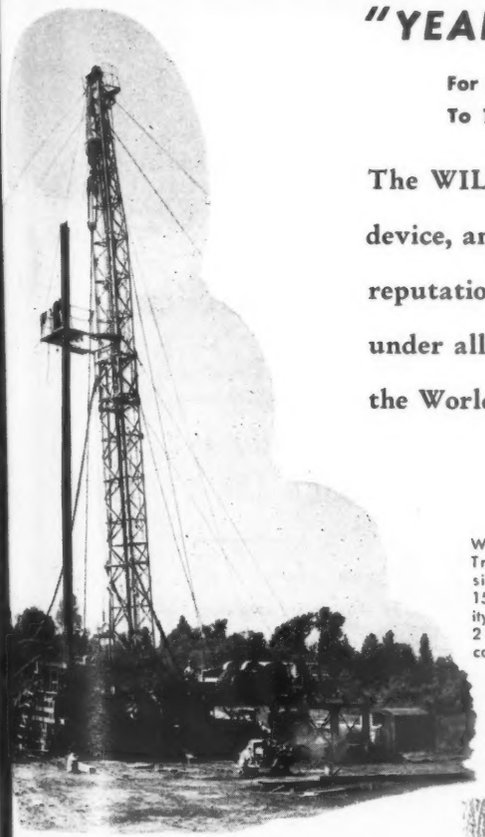
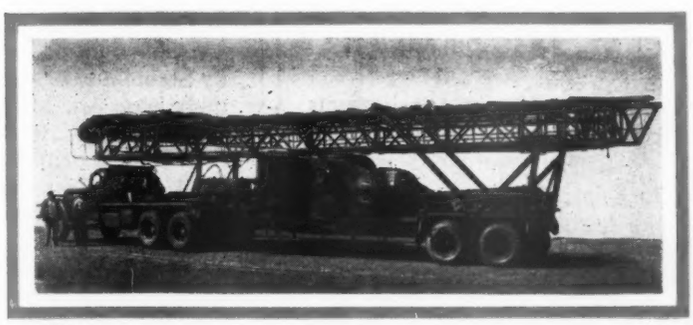


Above: Mogul Torcair Winch owned by Lee and Markham Production Company, Gladewater, Texas. On location for Phillips Petroleum Company, near Tyler, Texas.



Mogul Torcair Winch with Mast on Trailer. Made in two sizes: 90-Ft. height, 158,000-pound capacity; and 90-Ft. height, 260,000-pound capacity.

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EXPLORATION ACTIVITIES

Deep Test In Lea County

Additional pay promise was reported for a deep test in Lea County, New Mexico.

McAlester Fuel Company's No. 1 J. M. Denton took a drill stem test at 11,264-367 in the Devonian with tool open four hours. Gas hit surface in 45 min and mud and oil in 75 min. It flowed to pits for 45 min, was turned into tanks and gauged 30 bbl of oil the first hour and 25 bbl the second. Gravity was 44.5. Gas volume was estimated at 700,000 cu ft daily.

Wildcat Shows Gas

A strong gas showing has been reported in a Northeast Chaves County, New Mexico, wildcat. The well is Apache Oil Corporation's No. 1 Noble Trust Lands, about 40 miles northeast of Roswell.

On a 2-hour test at 6270-95 ft gas showed in three minutes. Recovery was 30 ft of distillate-cut mud.

Henry Caudill, Albuquerque geologist, said the test indicated a gas potential of 12 to 15,000,000 ft daily.

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To Drill 5 Arkansas Wildcats

South Arkansas has five new wildcat operations, three of which are in Union County, and the other two are in Miller County and Ouachita County.

Deepest of the Union trio is the C. H. Murphy and Company No. 1 Gregory, five miles south and two miles west of Cornie. Proposed depth is 9500 ft.

In Miller County Garland Anthony of Texarkana will drill the No. 1 E. A. Price, about a mile north of the Cypress Lake field, to 4200 ft.

Called a possible new strike in Ouachita County is the C. E. Miller No. 1 Mrs. Hattie Smith et al, where a show of oil is reported to have been found and production string is being run.

Stake Smackover Wildcat

A Smackover lime wildcat has been staked in the North Shongaloo field of Webster Parish, Louisiana, by Stanolind Oil and Gas Company and Hunt Oil Company. It is the No. 1 Lee Walker and others, and the well is one mile north of the Hunt No. 1 Roberts, which opened production for the North Shongaloo area when completed in 1945 for an initial output of 200 bbl of oil daily. Proposed depth of the new test is 12,000 ft.

Discovery in Michigan

A new Traverse lime oil discovery has been made by Don Rayburn in Bay County, Michigan. The well, No. 2 Cooper-Lucht, Pinconning Township, was rated good for at least 60 bbl of oil a day at 2283 ft, total depth.

Rayburn's No. 1 Cooper-Lucht was completed dry after tests indicated that a heavy water flow was drowning out a possible oil pay.

Gets Off-Shore Well

Two flow tests, with a rated flow of 447 bbl of oil daily has been reported by Stanolind Oil and Gas Company at their lease No. 1137, seven miles offshore of Cameron Parish, Louisiana.

The well, drilled to total depth of 9044 ft, set 7-in. casing at 9043 and perforated an interval from 8823 to 8828 ft.

On a drill stem test through perforations, with ¼-in. bottom and 3/16-in. top choke, the well flowed 34 gravity oil, for its initial test of 447 bbl. On the second test, using ¼-in. bottom and top chokes, the flow rate was 912 bbl daily, with a gas-oil ratio of 540-1.

Opens Wyoming Field

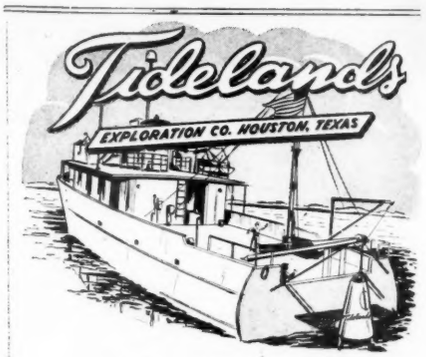
A wildcat well has been discovered in Fremont County, Wyoming by Sinclair Oil and Gas Company.

The company said there was an indicated flow of 1000 bbl daily of 37 gravity oil at around 6500 ft, and a considerable quantity of 36 gravity oil and natural gas at around 5900 ft, in this new well.

Superior Gets Production

Superior Oil Company of California's No. 1 Nutley on the Washita County, Oklahoma side of the Elk City pool, flowed 17 bbl of 52 gravity oil in 23 min from perforations at 9815 on a drill stem test with packer set at 9762 ft, to give the company its first production in the pool. Gas, estimated at 1,900,000 cu ft daily, showed in 28 min and the oil flow was turned into tanks after 62 min.

Recovery after the test was 2390 ft of oil and 180 ft of oil and gas cut mud. The well, an offset to E. Constantin, Jr. No. 1 Lambert, is drilling at 9932 ft.



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Hughes County Pool

Hughes County, Oklahoma has a new pool at Coronado Oil Company's No. 1 Stephenson, north of Atwood and four miles southwest of the Horn's Corner pool. Originally drilled by Atlantic Refining Company to 5459 ft in Wilcox, the hole was abandoned a year ago. It was taken over by Coronado and plugged back to 2873 ft in the Roach sand, and casing run to 2795 ft. The well swabbed at the rate of 75 bbl of oil per day, and now is being put on the pump.

Plan Wildcat Test

A wildcat oil test has been planned nine miles southwest of McAlester, Oklahoma, in Pittsburg County. The well will be spudded in jointly by Sunray Oil Corporation, Skelly Oil Company, and Oklahoma Natural Gas Company on a 22,000-acre block. It is to be on the Savanna anticline and will be drilled to the Cromwell sand, about 8000 ft.

The wildcat will be known as the Sunray-Skelly W. P. Mullen No. 1.

New Oil Field Found

McCarthy Oil and Gas Corporation has made a major oil discovery in the Collins Lake area of Brazoria County, about 40 miles southeast of Houston, Texas.

Glen H. McCarthy, president of the firm, describes the new oil find as the "most important discovery of my career." The new well is the McCarthy No. 1 J. P. Jamieson. It flowed at the rate of 644 bbl of oil daily through a ¼-in. choke on initial guage. It was drilled to a depth of 10,500 ft.

Tests Wyoming Well

Atlantic Refining Company's discovery of its No. 1 State-36 in Niobrara County, Wyoming, has opened a new pool for that company.

The well swabbed 295 bbl of 41-gravity oil in 24 hours from the basal Sundance formation at 3870-90 ft. Pipe was set at 3990 ft total depth. Atlantic has swabbed more than 500 bbl of oil into storage tanks on the lease and is installing pumping equipment. Oil shows were also had by operators from 3895 ft to total depth.

First Producer Due

Grimes County in South Texas will soon have its first oil or gas production, according to tests made at the E. G. Goforth No. 1 Fee, Berryman survey, in the Plantersville area.

The well is cleaning through a ⅛-in. choke, making an unestimated amount of gas and condensate from 7604 to 7610 ft in the Wilcox. Gas pressure has built up to 2100 psi.

North Dakota Test Dry

A North Dakota wildcat, four miles west of Grand Forks, has been called dry after drilling to 1685 ft. The well is Red River Development and Oil No. 1 Edgar Berg. It had been contracted for 3100 ft when drilling was begun.

Humble Opens New Field

Humble Oil and Refining Company has opened a new field in northern Kleberg County on the 971,711-acre King ranch with the No. G-1 King Ranch East Laurels. Casing was perforated at 6497 to 6505 ft after drilling to a total of 12,005 ft. Twenty feet of condensate was recovered with gas on a three hour and five minute test, at the South Texas well.

New Louisiana Oil Field

The Texas Company announced the discovery of a new Louisiana oil field with the completion of its No. 14 State-Rabbit Island well as a producer. The discovery well is situated on the North Flank of Rabbit Island Dome, Iberia Parish, Louisiana, in Atchafalaya Bay, approximately 25 miles south of Franklin.

The sand was perforated from 8824 to 8850 ft and flowed 292 bbl of 36.5 gravity pipe line oil per day and no salt water on a 9/64-in. choke on an initial test. Tubing pressure was 1510 lb and the gas-oil ratio 441-1.

The Rabbit Island Dome is located near the boundary between Iberia and St. Mary Parishes in Atchafalaya Bay and is approximately 14 miles southwest of The Texas Company's Belle Isle Dome and 10 miles southwest of Horseshoe Bayou Producing Field.

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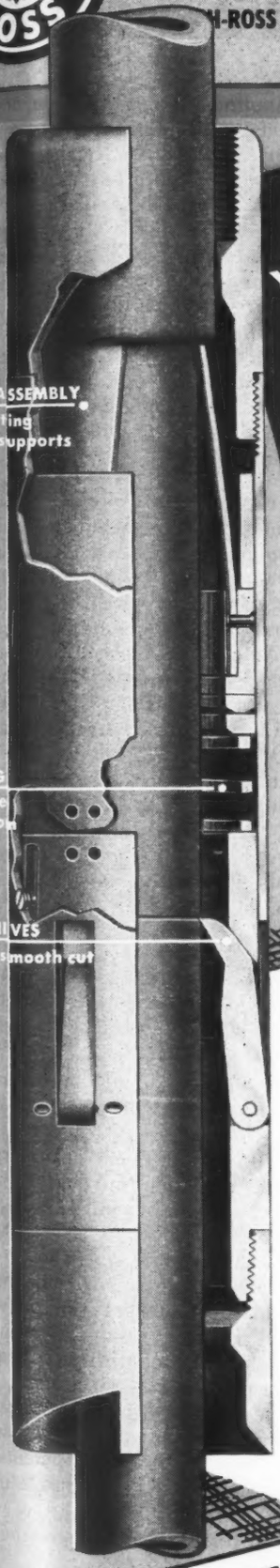
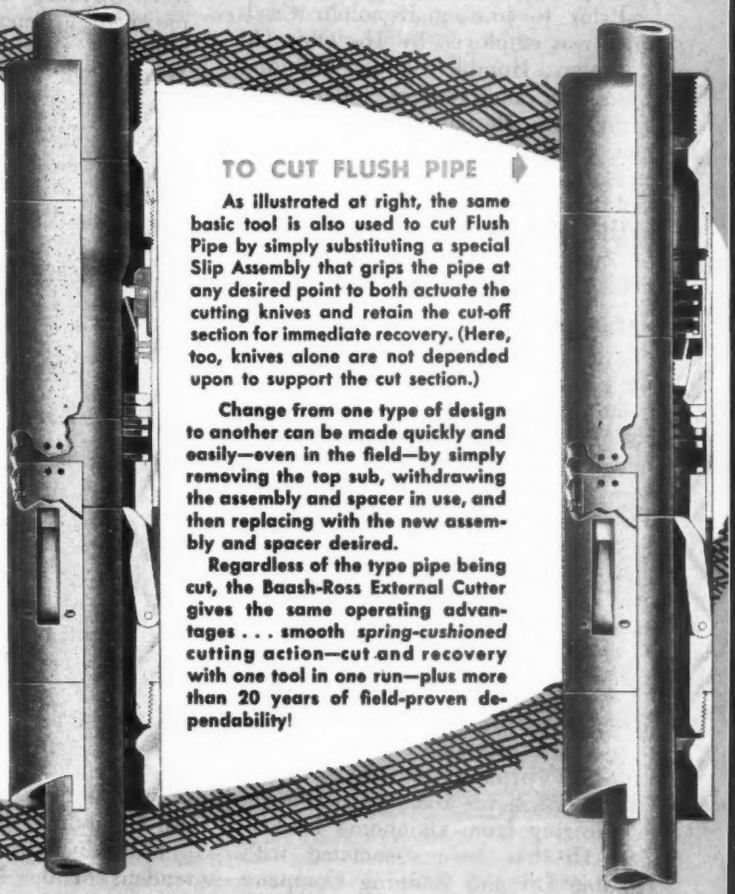


TO CUT REGULAR PIPE

As illustrated at left, for cutting Regular Pipe the tool is made up with Overshot Springs that catch under a tool joint or coupling to both actuate the cutting knives and then retain the cut-off section for recovery after cutting. (Note that the cut section is not supported by knives alone.)

TO CUT UPSET PIPE

As illustrated at right, the same basic tool is used to cut Upset Pipe by simply substituting a special assembly with "Dogs" that catch on the taper of the upset to both actuate the cutting knives and also retain the cut-off section for recovery on the same trip. (Note again that knives alone are not used to support the cut section.)



TO CUT FLUSH PIPE

As illustrated at right, the same basic tool is also used to cut Flush Pipe by simply substituting a special Slip Assembly that grips the pipe at any desired point to both actuate the cutting knives and retain the cut-off section for immediate recovery. (Here, too, knives alone are not depended upon to support the cut section.)

Change from one type of design to another can be made quickly and easily—even in the field—by simply removing the top sub, withdrawing the assembly and spacer in use, and then replacing with the new assembly and spacer desired.

Regardless of the type pipe being cut, the Baash-Ross External Cutter gives the same operating advantages . . . smooth *spring-cushioned* cutting action—cut and recovery with one tool in one run—plus more than 20 years of field-proven dependability!

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running tour with men in the industry

Bishop Craddock

Bishop Craddock of Sundown, Texas, has been advanced from field superintendent of the Slaughter field to Mid-Continent division field superintendent by Honoulu Oil Corporation.

The promotion was announced by Alden S. Donnelly, manager of Honolulu's Mid-Continent division, from his headquarters in Midland.

Craddock went to work with Honolulu approximately 12 years ago.

Prior to joining Honolulu Craddock was employed by The Ohio Oil Company, Humble Oil and Refining Company, and various independent contractors. He has also operated his own casing, rig building, and construction crews. He is generally known as "Blackie" Craddock.

His headquarters will continue to be in the Honolulu Oil Corporation field office at Sundown.

Harold J. Kleen, who has been district geologist for Skelly Oil Company since 1944, has resigned to become central division manager in charge of geological, land, and scouting for Kerr-McGee Oil Industries, Inc., in Oklahoma, Kansas, North Texas, Texas Panhandle and the Rocky mountain areas. He is a graduate of University of Nebraska, and was with the Nebraska Geological survey prior to 1937, when he joined Skelly at Tulsa, Oklahoma.

Paul R. Turnbull has been named manager of the drilling and production department for La Gloria Corporation of Corpus Christi, Texas.

Turnbull holds a B.S. in petroleum engineering from Oklahoma University. He has been associated with Humble Oil and Refining Company for several years, his recent position being that of division petroleum engineer in the Southwest Texas Division.

J. T. Gist, division geologist for West Texas and New Mexico, Pacific Western Oil Corp., Midland, Texas, has been transferred to Los Angeles, California. He will serve as regional geologist for the Rocky Mountain and Canadian areas.

George Vorbe, has joined the firm of D. D. Feldman Oil and Gas, Dallas, Texas, as chief geologist. Vorbe is chairman of the department of geology and advisor to the department of petroleum engineering New Mexico School of Mines, Socorro. He formerly served as district geologist for Texas Pacific Coal and Oil Company, and assistant district geologist for Stanolind Oil and Gas Company.

Glen Patrick, has been made district geologist at San Antonio, Texas, for American Republics Corp. He was formerly with Trans-Western Royalty Company. Prior to that time he served 10 years with Stanolind Oil and Gas Company.

Joe A. Huitt, Tulsa, Oklahoma, has been appointed manager of Deep Rock Oil Corporation's producing department. Former assistant to the vice president, Huitt replaces **Robert G. Martin,** who retires this month. Huitt joined Deep Rock as a roustabout some 20 years ago.

H. H. Arnold, Jr., has been named manager of exploration for McColl-Frontenac Oil Company and Texaco Exploration Company. Arnold was in Denver, Colorado, where he served as manager of the Rocky Mountain division of The Texas Company. He was geologist and petroleum engineer for The Texas Company for 23 years.

J. F. Dillard, mechanical engineer for Shell Oil Company, Monroe, Louisiana, has been transferred to the New Orleans division office. Other changes in personnel include: **C. R. Schriber,** drilling foreman, Black Bayou, Louisiana, to Morgan City; **E. W. Caldwell,** engineer's assistant, production department, Buras, Louisiana, to New Orleans.

L. W. Elderkin, was named production superintendent for North Texas division, succeeding **E. R. Shorey,** who was transferred as head of operations at Elk City field, in western Oklahoma.

Elderkin is former district superintendent of the McPherson, Kansas, area, having joined Shell in 1935. He is a graduate engineer from Oklahoma University.

The Stanolind Oil and Gas Company announced the promotion of two employees in the company's North Texas-New Mexico division. They are **John B. Rosen,** who will be district engineer in the Lubbock, Texas, district, and **George L. Ellis,** who advances from geologist to senior geologist at the Fort Worth division office. Ellis will direct geophysical and geological coordination. He replaces **F. H. Schouten,** who has been transferred to the Canadian division.

Rosen joined Stanolind in 1934, and Ellis in 1945.

Henderson Coquat, president and general manager of Longhorn Drilling Company, was elected chairman of the San Antonio chapter of the American Association of Oilwell Drilling Contractors, at a chapter meeting in San Antonio, August 29. Other officers elected were **Dan L. Clark,** Dan L. Clark Drilling Company, Corpus Christi, vice-chairman, and **Marvin W. Rogers,** Allen and Morris, secretary.

Outgoing officers include John E. Newman, Newman Brothers Drilling Company, chairman; Field M. Davis, Rock Hill Drilling Company, vice chairman, and T. Noah Smith, Jr., Logco Drilling Company, secretary.

Harvey T. Kennedy and **Joe A. Laird** have joined the petroleum staff of the petroleum engineering department of Texas A & M.

Kennedy, professor of petroleum engineering, received his bachelor of chemistry from Cornell University, and his Ph.D in physical chemistry from Johns Hopkins University. He is former associate scientist in heat and power division, U. S. Bureau of Standards, chief of materials and production chemistry division, Gulf Research and Development Company, Pittsburgh, Pennsylvania. His principle duties will be with graduate students in petroleum engineering.

He is the author of many technical papers published in leading trade magazines, and holds several patents.

Laird received his B. S. degree in petroleum engineering from Texas A & M, and his Masters degree from Oklahoma University.

He was formerly associated with Jo Cable, Texas Railroad Commission, George W. Strake, and for the past two years has served as an independent geologist and petroleum engineer in Houston, Texas.

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EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

L. B. Snedden has been transferred to Los Angeles, California, as assistant to division manager, Pacific Coast division, producing department, The Texas Company, according to E. R. Filley, general manager of the producing department.

Snedden came from Bakersfield, California, to Houston, Texas, where he was assistant manager, geophysical division. A native of Los Angeles, he was graduated from Stanford University. He was an instructor in field geology at Stanford before joining The Texas Company in 1935.

Ervin G. Kroker, manager of drilling operations for Kroker Drilling Company has been transferred to Roseburg Oregon, from Cumas Valley. He was previously a tool pusher.

S. F. Shaw, gas-lift specialist of San Antonio, Texas, was in Alberta, Canada, in September and part of October.

Robert V. Payne, geophysical party manager, and **R. James Wilkerson,** driller, have been transferred to Shell Oil Company's Long Beach, California, district. **Laurence C. Beck,** driller at Bakersfield, California, has been transferred to Ventura, California, in the same capacity.

J. Roy Derrick

J. Roy Derrick has joined King, Warren and Dye, Midland, Texas, independent oil operators, as production superintendent.

Derrick will be assistant to Phil Yeckel, general manager of King, Warren and Dye, and a partner in that concern.

Derrick has moved to Midland from Hobbs, New Mexico, where he resided the last year while serving as field superintendent for Wise and Hawkins, and Velma Petroleum Corporation. He was associated with Chemical Process Company, oil field acidizing concern for 10 years prior to his connection with Wise and Hawkins, and Velma Petroleum.

John W. Harrison, geologist for Argo Oil Corporation, working out of the San Antonio, Texas, office, has been transferred to the geological office in Casper, Wyoming. **M. T. Rathvon,** who has been with Argo and its predecessor companies for more than 30 years, is retiring as vice president and general superintendent of the company.

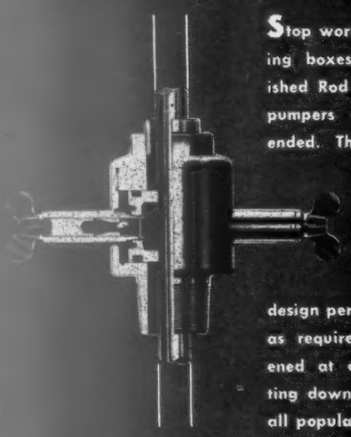
R. R. Ullstrom, will be general superintendent, with headquarters in Denver, Colorado.

H. C. Vanderpool has been elected president, and **W. Baxter Boyd,** Continental Oil, has been elected vice president of the Fort Worth Geological society.

R. E. "Dick" Duty, former division geologist for W. C. McBride, Inc., has resigned to become a consultant at Mt. Vernon, Illinois.

Paul L. Lyons, Tulsa, Oklahoma, has been appointed to the newly created post of technical assistant to H. F. Moses, vice president in charge of exploration and research of Carter Oil Company. He formerly was a technical assistant in the department. In his new position Lyons will co-ordinate all geological and geophysical work in Carter's territory of 24 states.

Positive Seal Under Toughest Conditions



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The Hunt Wire Line Core Barrel has fewer parts and threaded connections, by far, than any other wire line barrel. This means less inventory requirements, more economical operation and greater dependability. Check it on your next job . . . and let the Hunt Wire Line Core Barrel check the job for you.

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HUNT TOOL COMPANY H

A BUSINESS BUILT ON *Good* SERVICE

▸ **J. M. Hansell** has been appointed geologist for the Canadian division of Sun Oil Company's production department, John G. Pew, vice president in charge of production announced. Canadian division headquarters is at Calgary, Alberta Province.

Hansell joined Sun 15 years ago and worked in several districts of the company's southwest operations before moving to Dallas, Texas, last year to become regional geologist for the area east of the Mississippi River. He came to Dallas from Corpus Christi, Texas, where he served as district geologist. A native of Iowa, he attended the Universtiy of Wisconsin and received his Ph. D. in geology there in 1928.

Other shifts of personnel announced in Sun's southwest division include the appointment of **W. H. Devine** to the development geology in the Jameson area, West Texas, and the transfers of **Sam Coggin** from the Jameson area to the geological department in Dallas; **W. L. Erwin,** from Tallahassee, Florida, to Jackson, Mississippi; **James A. Alcorn,** from work in the Dallas office to surface work, and **Louise Jordan,** from Tallahassee to Amarillo to do paleontological work in that district of the Texas Panhandle.

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EXPERIENCED PRACTICAL AND TECHNICAL CONSULTING PRODUCTION ENGINEERING SERVICE

•

SPECIALIZING in MODERN SECONDARY RECOVERY

▸ **E. I. Grizzell,** party chief for Independent Exploration Company, Houston, Texas, recently returned from a several year tour of duty in the Mid-

E. I. Grizzell

dle East, including Iraq, Qatar, Syria, and the Trucial Coast. Grizzell believes his party was among the first to make seismograph surveys in Syria. He has now been placed in charge of an Independent Exploration party in Montana.

▸ **P. W. Wolf,** Delta Drilling Company, has been transferred to Kyle field at Medicine Bow, Wyoming. He was formerly tool pusher in the Newcastle, Wyoming, area.

▸ **F. G. Culbertson,** Humble Oil and Refining Company, has been transferred to the company's general office in Houston, Texas, as associate petroleum engineer. He was formerly at Tomball, Texas. **Delman Baucum,** assistant district superintendent at Freer, Texas, has been transferred to Colorado City, Texas, as district superintendent.

▸ **Henry Bollig** has joined Gold-Rubin Oil Properties as production superintendent at Borger, Texas. He was formerly district superintendent for Ryan Consolidated Petroleum Corporation, Okmulgee, Oklahoma.

▸ **Otto Wendenburg,** Gulf Research and Development Company geophysicist, has been transferred from Laurel, Mississippi, to Alexandria, Louisiana. There he will be engaged in interpretation of seismic data.

▸ **W. A. Sinsheimer, Jr.,** has joined DeGolyer and MacNaughton Company, Dallas, Texas, as a petroleum engineer. He was formerly with Raymond F. Kravis, Tulsa, Oklahoma.

▸ **Thomas B. Smith, II,** former petroleum engineer with Stanolind Oil and Gas Company at Brownfield, Texas, has joined Eastern Engineering Company, Atlantic City, New Jersey. He has been made assistant superintendent for that company.

▸ **E. W. Luster** has been named manager of the Esso Engineering Department of Standard Oil Development Company, central research affiliate of Standard Oil Company (New Jersey).

Luster succeeds **N. E. Loomis** who retains his position as vice president of the Development Company, while relinquishing his duties as department manager in order to devote more attention to general policy matters.

C. E. Paules, formerly associate chief engineer, succeeds Luster as chief engineer.

Luster is a graduate of Rutgers University. He joined Standard Oil Company (New Jersey) in 1916 and the Development Company in 1928.

▸ **Clay Mullins** has been transferred from Sun Field to Sour Lake, Texas, where he will serve as district foreman for Sun Oil Company.

▸ **J. W. Darnell,** landman at Clinton, Oklahoma, for Sinclair Oil and Gas, has resigned to become an independent trader there. He is succeeded by **John C. Noble,** former scout in northern Oklahoma, who in turn is succeeded by **J. W. Kaboth,** formerly at Casper, Wyoming. Kaboth will work out of the Oklahoma City office.

▸ **W. H. Barclay** has been named assistant general superintendent of production of Midstates Oil Corporation. Barclay has had wide experience

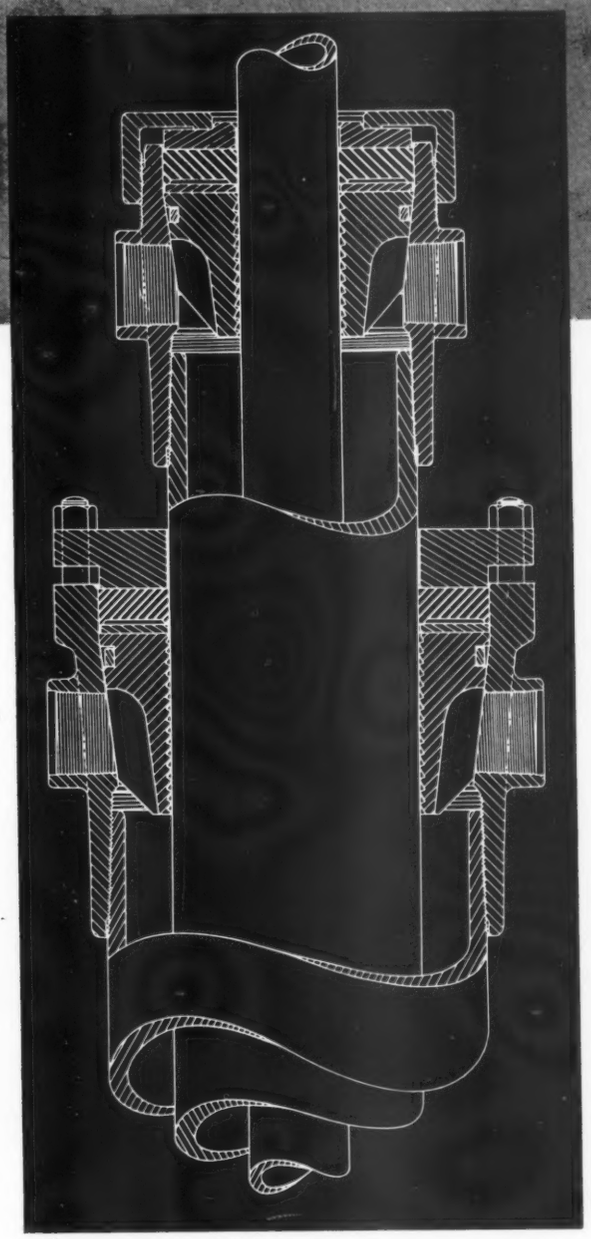
W. H. Barclay

in the oil industry over a period of 28 years as secretary, accountant, supply man, field clerk, and production superintendent. He has also been connected with transportation, inventory and purchasing departments, and has engaged in equipment engineering work.

He has been associated with Bovaird Supply Company, Marland Oil Company, Darby Petroleum Corporation, Darby and Bothwell, Inc., and Tidewater Associated.

He studied business administration and production engineering at the Universities of Oklahoma and Tulsa.

THE RECTOR REDHEAD TYPE R



ORGED STEEL
ASING and TURBING HEADS

- Interchangeable Stripper and Slips
- Three Segment Type "Ribbed" Slip Construction
- Full Opening Body
- Oil and Gas Resistant Packing Ring
- Minimum Height—Maximum Efficiency

It's features like these that make Rector Type R Forged Steel Casing and Tubing Heads outstanding among low cost heads for low pressure wells.

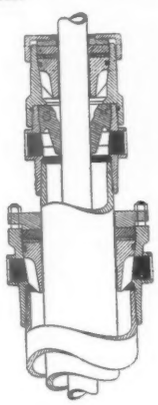
Their forged steel bodies have greater thickness and weight than any casing or tubing to which they would be attached. Ribbed construction of slips permits full flow to the outlets and minimum body height. The bodies have all threaded connections. Tubing head may be furnished with flanged bottom connection for replacing high pressure casing and tubing heads when changing to artificial lift.

Both casing and tubing heads have special oil resistant packing ring pack-off.

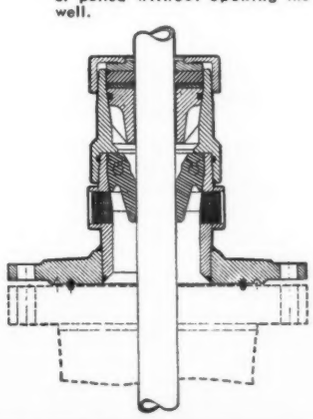
The Type R Tubing Head can be furnished with slip bowl adapter to carry slips, packing and gland, so that stripper can be carried in head body. Use of stripper makes it possible to run tubing without ever opening well. Stripper and slips are interchangeable so that two strippers can be used if desired.

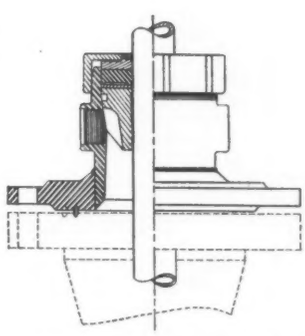
Redhead Type R Casing and Tubing Heads are adaptable to a wide range of installation preferences. Write for latest bulletin giving complete details and adaptability of the new Type R Forged Steel Casing and Tubing Heads.

BELOW: Type R Casing and Tubing Head assembly with slip bowl adapter and stripper in place.



BELOW: Type R Tubing Head with flanged bottom connection, slip bowl adapter and stripper. This type assembly is ideal for wells having pressure and intermittent flow. Tubing can be run or pulled without opening the well.





ABOVE: Type R Tubing head with flanged bottom connection. Head is screwed and welded to flange. This arrangement is used to replace Christmas Tree when well ceases to flow or for initial installation of low pressure well with flanged casing head.

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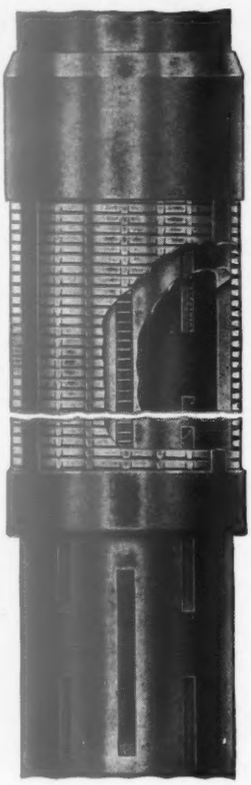
Screen Pipe

For Any Requirement . . .

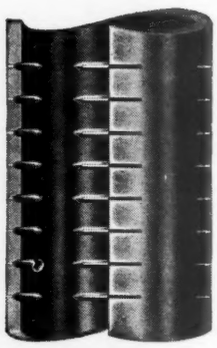
Emsco products are backed by long experience in well screening problems. Years of successful use and scientific testing in U. S. and foreign fields have proved their superiority.



WIRE WRAPPED

Emsco Wire Wrapped Screen with Vertical Slots provides 50% to 60% more opening per foot than conventional drilled holes. It retains 25% more tensile strength than drilled pipe.

FOR MAXIMUM AREA, Emsco Double Slotted Wire Wrapped Screen provides 100% to 150% more opening per foot and can be used with absolute safety.



SLOTTED

Emsco Slotted Screen Pipe retains 80% to 85% of the original collapsing strength of the pipe. It may be rotated or spudded reasonably without risk of damage. Its smooth surface facilitates setting and pulling . . . prolongs its life. Slots are milled from the inside and sawed from the outside, "V" shaped for maximum drainage and minimum clogging. 1/8" straight wall connects outside opening to beginning of "V" on inside. Slots are so arranged that strips of solid steel run full length of pipe. A few feet of screen provides drainage area equal to full capacity of the pipe.

EMSCO GRAVEL PACK

Emsco Prepacked Gravel Pack Screen eliminates screening problems where fine, flourlike sand cannot be controlled by conventional slotted or wire-wrapped screens. Especially selected sand or gravel of appropriate size, pressure packed between two joints of Emsco Slotted Screen Pipe, prevents passage of the very finest sands. Thus it keeps the wall open, reduces workover and production costs. Each joint of Emsco Prepacked Gravel Pack Screen is made to meet individual specific conditions. Packing is sealed at top and bottom to assure permanency. Each joint is a separate, complete unit as easily handled as regular standard screen.

EMSCO SCREEN PIPE CO.

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▸ **H. W. Brown** has been named assistant chief geophysicist of The Carter Oil Company, Tulsa, Oklahoma. Until recently, Brown served as supervisor of foreign geophysical operations. A graduate of Louisiana Polytechnic Institute, Ruston, Louisiana, Brown joined Carter's geophysical department in 1935.

R. F. Weichert, formerly on loan to the Imperial Oil, Ltd., from Standard Oil Company (New Jersey) will assume the position of foreign geophysical operations. A graduate of Rice Institute, Houston, Weichert joined Carter in 1935.

R. C. Clark, who has recently served as supervisor of geophysical operations in Carter's Northwest division, will become assistant supervisor of foreign operations. Clark, who is a graduate of the University of Nebraska has been with Carter since 1935.

C. N. Hurry will become supervisor of domestic geophysical operations. Hurry, associated with geophysical work in the United States and Canada, began with Carter in 1935.

▸ **Charles Gill Morgan,** consulting geologist, has announced the removal of offices to Mercantile Securities Building, in Dallas, Texas.

▸ **Philip H. Jennings** will be transferred from Houston, Texas, where he has been district geologist, to Magnolia Petroleum Company's general offices in Dallas to be a staff geologist. **W. R. Canada** will be promoted to district geologist in charge of the Houston-Lake Charles District.

▸ **J. P. Schmalz,** district petroleum engineer for Magnolia Petroleum Company at Rodessa, Louisiana, was chosen to be recipient of Magnolia Petroleum Company's producing division fellowship for the coming year. He has been granted a one year leave of absence for further studies in the field of petroleum engineering.

J. F. Mayfield, formerly petroleum engineer in East Texas' Rusk district, has been transferred to the Rodessa producing district.

Joseph E. Dinger, also of Magnolia, who has been assistant foreman in the Falfurrias, Texas district, has been promoted to production foreman in the Lake Charles, Louisiana district.

▸ Credited with saving his own son's life, **John Robert Bush,** roustabout at the Withers Gas Compressor Plant, The Texas Company, was awarded the National Safety Council President's Medal.

Presentation of the award was made by C. A. Miller, division manager, Southern division, personnel department, in charge-safety. Oscar Hillyer, Jr., supervisor, industrial relations, South Texas Division, producing department, was master of ceremonies. The safety council recognized Bush with its highest award for his alert action on May 4, 1949, in saving his son from asphyxiation by exhaust fumes from the muffler of the Bush car.

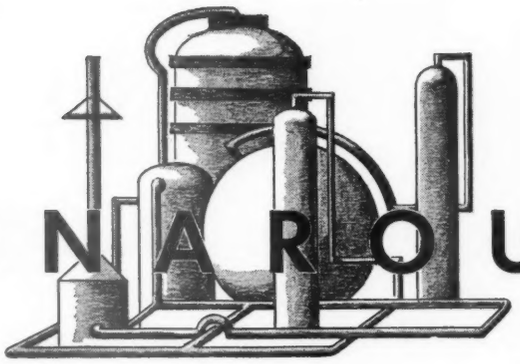
▸ **R. M. Hess** has been made East Texas division production superintendent of Shell Oil Company, Inc. Hess is former division exploitation engineer. In his new position, Hess, who has been with the company since 1926 will be responsible for operations and activities in the Quitman and Kilgore districts.

J. F. Courtney has been placed in charge of the Quitman district, and George Barnes is district foreman at Kilgore.

K. R. Bowie is now exploitation engineer (area) in the Houston office. He began working for Shell in 1935.

These personnel changes are a result of reorganization of the East Texas production division of Shell. The major portion of administrative, planning, development, and engineering functions have been consolidated at the division office in Kilgore.

THE TURNAROUND



Constructive vs. Destructive Demolition

WORLD economics and technical development go hand-in-hand in the effort to rebuild world industry and commerce to a profitable level again. Axiomatic to that attitude is the problem engendered by the destruction of Germany's synthetic hydrocarbon plants.

Numbers of these plants have been dismantled by Eastern and Western Powers. Recently British authorities had issued repair permits for six of the ten synthetic plants in Western Germany. Several of these plants are now being dismantled, chiefly oil-from-coal units. The synthetic oil industry is banned by the tripartite agreement of April 13, 1949. The synthetic hydrocarbon plants at Castro-Rauxel and at Wanne-Eickel are allowed to operate due to severe soap shortage, but will shut down not later than the end of 1949.

The Berguis-process brown-coal hydrogenation unit is running at Wesseling to make ammonia and methyl alcohol, and to refine natural crude and its residues. Decision is reached that the plant of Gelsenberg Benzin Company is unnecessary. At the end of the war synthetic oil was supplying 50 per cent of Germany's needs.

Simultaneously Western money is being poured into Germany to bolster her prostrate economy. Such a program can become cancerous, an intolerable burden on the already overloaded American taxpayer. We are eliminating all chance to make Germany self-sustaining; we are removing all chance to get the Germans off the neck of the American economy.

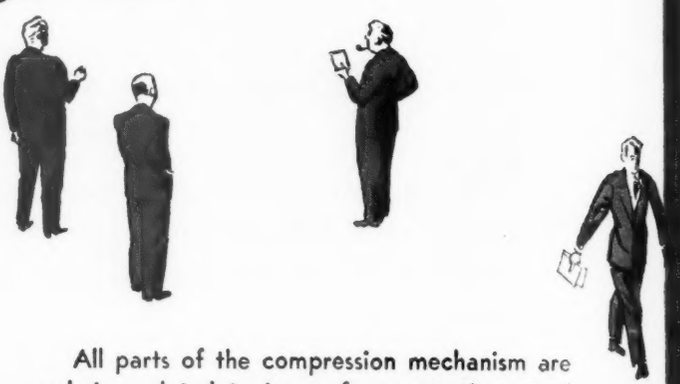
German technology had advanced far in the development of synthetic processes; the great bulk of the know-how in these lines is part and parcel of German experience. To eliminate completely Germany's ability to produce finished goods means death to all chemical engineering activity except possibly of the most rudimentary sort.

To allow developments or to perpetuate capacities that can result in a repetition of World War II is unthinkable. To maintain the German people as mendicants drawing from the production of other nations is equally an impossible situation. A solution to the dilemma that will permit the German plants to continue to supply them with the necessaries, yet that guards them against conversion to war-making machinery is extremely difficult to reach, yet on the proper management of the problem rests a major part of the solution of Germany's future and that of the world.—ALF.

NEW! POSITIVE-SEAL

IN VOGT TWO-PASS SHELL HEAT

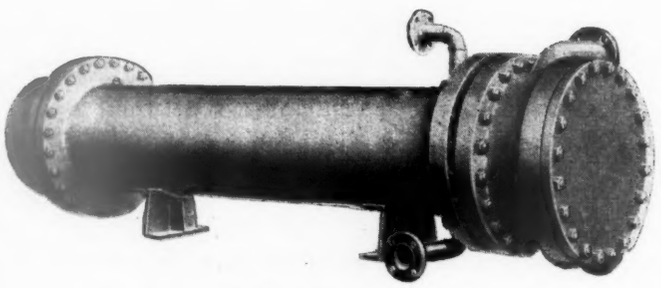
VOGT ENGINEERS SOLVE NUMBER ONE HEAT EXCHANGER PROBLEM



How to provide an absolutely tight seal for the longitudinal baffle in two-pass shell heat exchanger construction has long been the concern of heat transfer equipment builders but its attainment has eluded them until now. Today, the Vogt Positive-Seal Two-Pass Baffle described and illustrated here, operates with high efficiency in units serving many industries.

BAFFLE CONSTRUCTION

The baffle consists of a solid plate, inserted between the tube sheets of the tube bundle, having outwardly opening channels on each side. After inserting the tube bundle in the shell, there is loosely placed in each channel, and in the order named, a compression mechanism composed of a longitudinal series of pivotally connected steel links, a steel backing strip, and a suitable packing.



This two-pass shell Solution Cooler is equipped with the Vogt pivoted-link baffle sealing mechanism.

All parts of the compression mechanism are cadmium plated to insure free operation at all times.

SEALING THE BAFFLE

To seal the baffle, after the bundle is in position and prior to bolting on the cover of the unit, it is only necessary to turn the nut of the compression screw on the end of the compression linkage so that it bears against the locking washer. A stop in the other end of the baffle channel forces the adjacent end of the linkage, as well as the intermediate links, in a toggle-like action outwardly against the backing strip. Each link adjusts itself individually to transmit equal pressure along the length of the packing as it conforms to any unevenness of the shell. To remove the bundle from the shell, the seal is broken by backing off the compression nut whereby the linkage is retracted and pressure is removed from the packing.

Vogt Two-Pass Shell Exchangers are used in all services where overlapping temperatures ordinarily require two single pass shells.

HENRY VOGT MACHINE CO.

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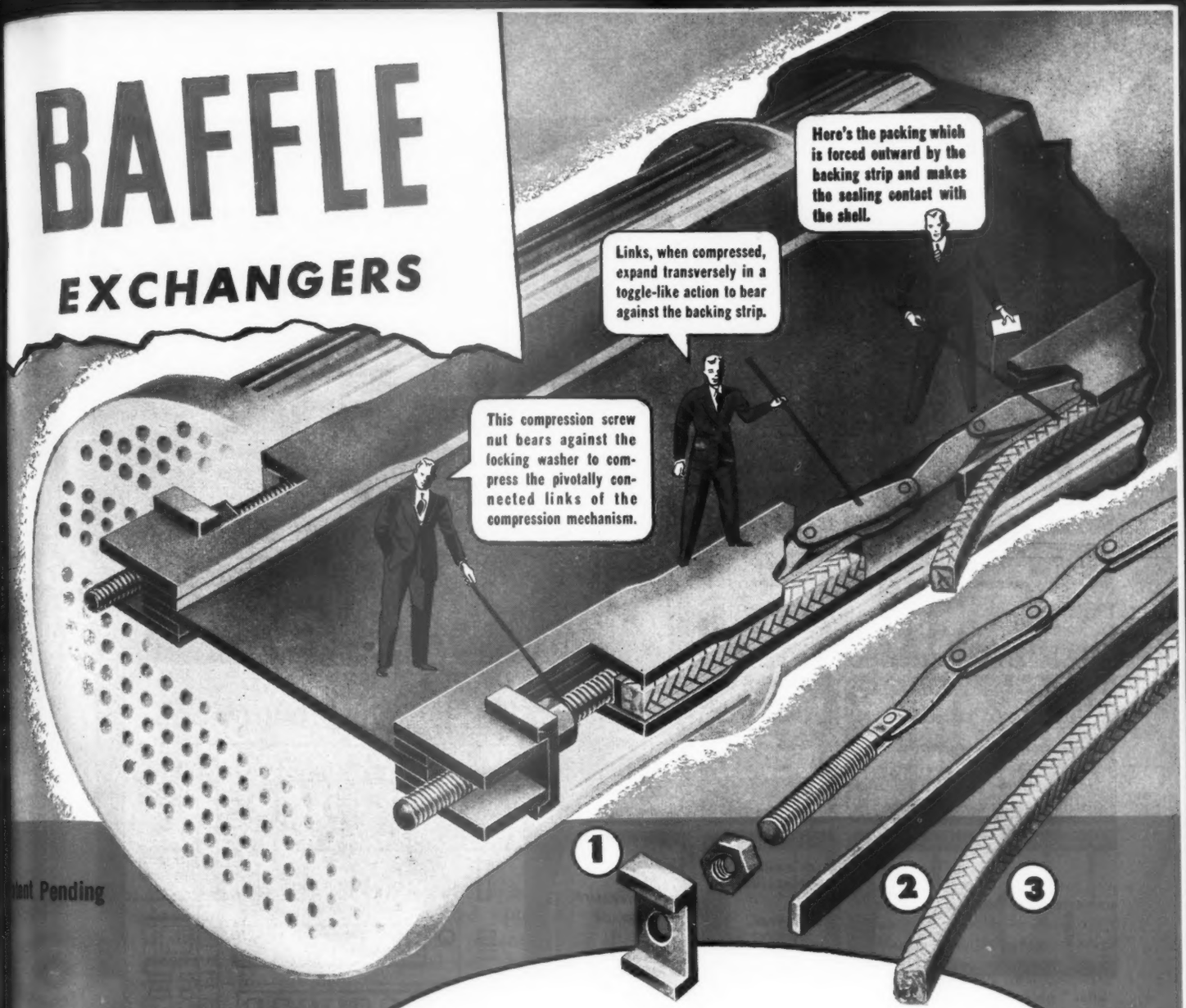
BAFFLE
EXCHANGERS


Here's the packing which is forced outward by the backing strip and makes the sealing contact with the shell.
Links, when compressed, expand transversely in a toggle-like action to bear against the backing strip.
This compression screw nut bears against the locking washer to compress the pivotally connected links of the compression mechanism.

ant Pending

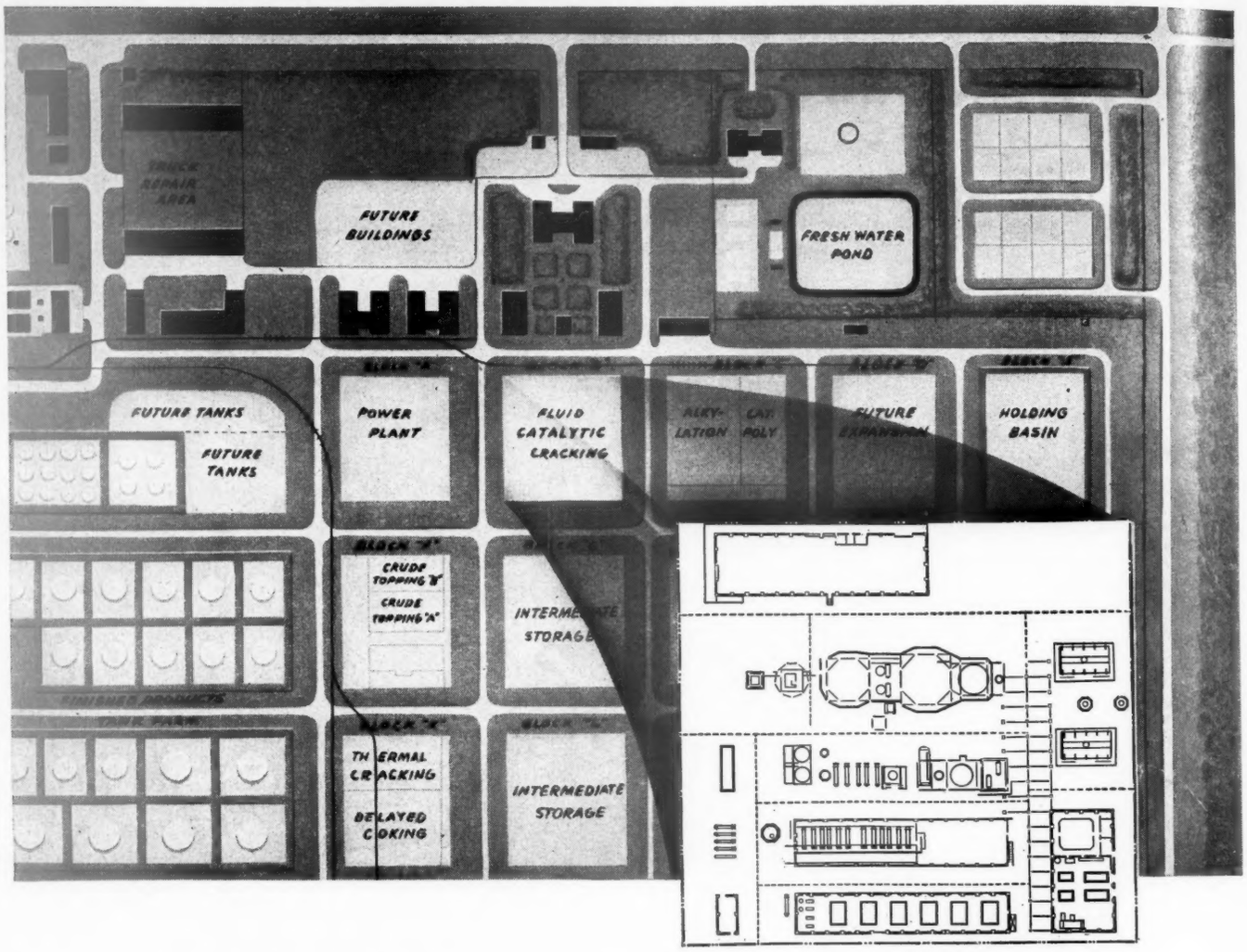
1 Exploded view of locking washer, compression nut, and screw attached to compression linkage.

2 Steel backing strip which equalizes pressure against packing.

3 Packing which makes the seal between baffle and shell.

Vogt
POSITIVE-SEAL 2 PASS
HEAT EXCHANGERS

N.B. While it is axiomatic that return on investment—the *ultimate earning power* of a refinery unit when actually on stream—is the only true evaluation of competitive engineering recommendations, initial plant costs remain a major factor in refiners' decisions on plant installations. M. W. Kellogg takes specific steps to *minimize initial plant costs* consistent with the achievement of *highest ultimate earning power.*



PLOTTING TO SAVE THOUSANDS OF HOURS

The process plan is approved. Now comes the engineering—a simple phrase but a mammoth task. Proper coordination at this point can mean thousands of engineering hours saved . . . many weeks cut off final delivery date of the completed refinery.

Kellogg solves this problem in a unique manner. *Before* design engineering is started, every project is referred to a compact engineering PLANS GROUP, composed of broadly-trained specialists in every major phase of refinery engineering. This PLANS GROUP—with the active collaboration of process, project and construction engineers—*pins down* in cooperative effort every factor that might appreciably affect the overlapping phases of the work. In short it creates a fixed yet elastic plant layout.

The PLANS GROUP plots within defined limits the location and servicing arrangements for all equipment; vessel and piping clearances; utility entrances and exits; pipeway and heat exchanger banks; and a host of other variables that, once established, permit the specialized design divisions to proceed independently in engineering their particular portions of the plant.

This intensified, cooperative effort has virtually eliminated re-engineering time. And as production engineering now proceeds simultaneously in *all* phases, on a uniform, pre-fixed basis, the average time saving on engineering has been in the neighborhood of 20%—with a corresponding advancement of completion dates.

The success of this type of operation is dependent in large measure on *the size and completeness* of Kellogg's technical man-power pool, from which key specialists can be drawn to exactly match the requirements of any problem posed . . . and on the *breadth* and depth of practical experience those men enjoy. Both are necessary to truly achieve LOW INITIAL COSTS without sacrifice of other important considerations.

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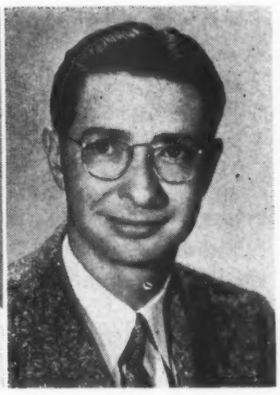
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THE TECHNICAL FORUM

A Clearinghouse for Technical, Chemical, and Engineering Know-How for Men in Refining and Gas Processing

ONE of the most effective methods by which problems can be solved and information be disseminated is that of the quiz program, in which the questioner propounds his problem, and to which an answer is given by an authority on that subject. It is obvious that a group of specialists are able to give more authoritative answers, each in his own field, than can a smaller number of technologists dealing with the same questions.

Herewith THE PETROLEUM ENGINEER presents a group of 20 consultants, each a specialist and an authority in his chosen field, who have agreed to cooperate in answering knotty questions of technology, chemistry, engineering, and utilization of petroleum and its products, for readers of this Refining and Gas Processing magazine. The scope of the Forum covers the entire expanse of these fields, and questions may deal with any given phase in which the questioner is interested. It is planned to make this a most comprehensive and authoritative feature for the technologist, chemist, engineer, operator, and all interested members of the industry. For the first time the reader may dictate the discussion.

This department is open to every interested person in these industries. The different fields in which each authority is interested and in which he will give answers to questions are indicated opposite each individual.

The personnel of the consulting panel may change from time to time, and new members will be added whenever it appears desirable or an outstanding authority becomes available to join the panel. A copy of each answer will be supplied to the questioner at the earliest practicable date after receipt of a question; publication of these answers will follow in this department at as early a date as is practicable.

We believe this to be the most advantageous and useful service yet offered to our readers. THE PETROLEUM ENGINEER will serve as a clearinghouse to bring questioner and consultant together for their mutual benefit.

Send all questions, signed by the questioner to

THE PETROLEUM ENGINEER,
P. O. Box 1589,
Dallas 1, Texas.

Questioner should state whether or not name and/or professional connection may be employed in publication. Customarily, only initials will be attached to the published question. Questions should be bona fide and useful, and may deal with subjects ranging from the purest form of research to everyday operating problems.

FORUM MEMBERS

Charles J. Boner, who has been researching in grease for nearly a quarter-century, is chief research chemist for Battenfeld Grease and Oil Corporation. After graduating from University of Missouri he went to work making "solid" lubricants. His subjects will be grease manufacture and allied topics.

J. A. Altschuler, vice president of Stratford Engineering Corporation, directs the activities of the company in the development of separation processes for petroleum products; improved treating processes, and grease-making. A graduate of University of Pittsburgh, he has spent much time in work abroad. He will deal with grease manufacture topics, other refining processes.

Robert C. Davidson received his BS in applied chemistry from California Institute of Technology. He had refinery experience with Socony-Vacuum Oil Company before he became a technical service engineer with Filtrol Corporation. His subjects will be catalysts and catalytic cracking.

A. M. Platt is assistant professor chemical engineering at Texas A & M College. He has a BS from Carnegie Institute of Technology; spent five years in the research and development laboratories of Socony-Vacuum Oil Company. He is doing research on alkylation, isomerization, oil decolorization, and thermal and catalytic cracking. His topics will include theory of reactions, thermodynamics, fluid flow, instrumentation.

Roger S. Shute is technical service engineer with Filtrol Corporation. He received his ChE degree from Rensselaer Polytechnic Institute and MS from University of Pennsylvania. He joined The Atlantic Refining Company; later went with Filtrol Corporation. He will discuss various phases of catalytic cracking.

FORUM TOPICS

Grease Manufacture
Lubricating Greases
Specialty Lubricants

R. R. Matthews

Butadiene
Synthetic Rubber
Organic Chemicals
Petroleum Hydrocarbons

James H. Boyd

Chemical Engineering
Thermodynamics
Use of Petroleum and Its Products

G. G. Brown

Catalytic Cracking
Cracking Catalysts
Refining Process Design
Thermodynamics
Distillation—Adsorption
Heaters

W. C. Edmister

Catalysis
Catalytic Cracking
Correlated Phases of Refining Technology

W. F. Faragher

TECHNICAL FORUM MEMBERS

Executive vice president of Battenfeld Grease and Oil Corporation, Ralph R. Matthews graduated in chemistry from the University of California in 1912; was a "charter member" in the organization of the Bureau of Mines office and laboratory in San Francisco, thence to Shell Oil Company as a chemist. Shell needed a top-hand in Rozana Petroleum Company at Wood River, Illinois, gave the job to Ralph Matthews. He is an authority on the manufacture, technology, and the scientific application of greases and specialized lubricants in all phases of industrial and commercial lubrication. He has been prominent in the difficult tasks of preparing practical specifications for lubricants.

Consulting chemical engineer of New York City, James H. Boyd has had wide experience in petroleum, natural gas, and petrochemical fields. Receiving a BS degree for Kenyon College in 1924, he was granted a MS from Massachusetts Institute of Technology in 1926, DSc in chemical engineering, 1930. Later experience came with Atlantic Refining Company on cracking and petroleum specialties; the Dupont Company in supervising ethylene glycol and nylon intermediates pilot plants; and with Phillips Petroleum Company and its subsidiary, Hycar Chemical Company, on the technology and economics of synthetic rubber and other chemicals.

Chairman of the Chemical and Metallurgical Engineering Department, University of Michigan, is George Granger Brown, who has been active in research and development work in the refining and gas industries for nearly 25 years. He is an outstanding authority on natural gasoline, chemical engineering, thermodynamics, and physical chemistry of light hydrocarbons, fractionation and distillation, and other allied subjects. With a BS in chemical engineering from New York University in 1917, he served with the Chemical Warfare Service, then with Aluminum Company of America and Youngstown Sheet and Tube Company, joining the University of Michigan in 1920.

Professor of chemical engineering at Carnegie Institute of Technology, Wayne C. Edmister has successively been process engineer, Standard of Indiana; technical assistant to the vice president, Rubber Reserve Company; senior process engineer with Foster Wheeler Corporation; consultant with Hydrocarbon Research, Inc., on process design of nuclear reactors, iron and steel processing, and coal gasification. He served several months as consultant with Allied Chemical and Dye Corporation. He is a graduate of Oklahoma A & M College at Stillwater, and has a MA degree from his Stillwater Alma Mater. Edmister has published many articles on thermodynamics applications and process design.

Houdry Process Corporation's research and development department has W. F. Faragher as assistant to the vice president. His professional history reads like a roster of the major petroleum research developments during the last 40 years. He served as instructor at the University of Kansas during his doctorate study and was founder of the petroleum refinery engineering department at Pittsburgh University. He became assistant director of Mellon Institute; director of Universal Oil Products Company's Riverside laboratory; assistant chief of research and development for Socony-Vacuum; research director for Houdry Process in charge of foreign activities.

FORUM TOPICS

TECHNICAL FORUM MEMBERS

Theory of Reactions
Chemical Kinetics
Thermodynamics
Fluid Flow
Instrumentation

G. L. Farrar

In 1947 G. L. Farrar became assistant professor in the chemical engineering department of Texas A & M College. He graduated with honors from Texas Technological College in 1942, with a BS in chemical engineering. He worked with the field research department of the Magnolia Petroleum Company, and the research department of the Socony-Vacuum Oil Company, in Paulsboro, New Jersey, from 1942 until 1947, when he was appointed assistant professor of chemical engineering at Texas A & M. He will receive the MS degree from A & M in January, 1950, and the professional degree of Chemical Engineer from Texas Tech College in June, 1950.

Process Economics
NG Plant Design
Distillation—Absorption
Refrigeration
Instrumentation

A. S. Glendening

Sanderson-Glendening is a firm of consulting engineers in New York of which Alan S. Glendening is a member. A native of Paris, France, Glendening graduated from Princeton in 1944 with high honors and was granted the Phi Beta Kappa award. Since then he has been designing natural gasoline and cycling plants with Petroleum Engineering, Inc., Houston, Texas, until October of 1948 when he became partners with C. F. Sanderson with offices in Houston. The consulting firm specializes in the design of natural gasoline and cycling, and chemical plants of numerous types, absorption, refrigeration, and process instrumentation.

Refining Economics
Chemical Treating
Fluid-Solid Contacting
Reactor Design
Petroleum Chemicals

John Happel

Professor of chemical engineering and chairman of the department at New York University, John Happel is best known to the oil refining industry and to chemical research for his nearly 20 years work with Socony-Vacuum Oil Company, Inc. He received his BS and MS degrees from Massachusetts Institute of Technology. Happel organized and taught classes in chemical engineering at Brooklyn Polytechnic Institute from 1945 to 1948, with some teaching work at the University of Delaware, also. He received his doctorate in chemical engineering at Brooklyn Polytechnic Institute, and has been a full professor at New York University since 1948.

Petroleum Acids
Petroleum Bases

H. L Lochte

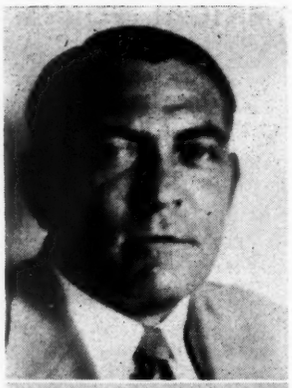
H. L. Lochte is professor of organic chemistry, University of Texas. He has given his entire time to study, teaching, and research on organic chemicals since receiving the PhD degree from the University of Illinois. Lochte's earlier work was in catalysis, for reduction of the double bond between nitrogen and carbon to a single bond. Joining the University of Texas chemical staff in 1922, he worked also on corrosion problems in oil and gas equipment, analytical problems in organic materials, and in separation and identification of organic acids and bases especially as found in petroleum. Dr. Lochte will discuss petroleum acids and bases, their occurrence and properties, etc.

Chemical Treating
Application of Steels and Alloys to Petroleum Industry

Chas. W. Rippie

At Lukens Steel Company, Charles W. Rippie is the petroleum consulting technologist working on corrosion and allied problems. After a PhD at University of Illinois in chemistry and engineering, Rippie joined Shell Oil Company at Wood River-St. Louis for eight years, working on refinery problems, assistant to the vice president of manufacturing. His overall picture of and knowledge of petroleum chemistry led him into the Solvay Sales Corporation where for six years he was technologist on the chemical treatment of petroleum products, and during which time he was in direct contact with the treating problems of the great majority of American refiners.

FORUM TOPICS



Heaters
Furnaces
Oil Heating Processes

Frank H. Praeger

Process Design
Management
Process Economics
Operational Techniques

Robert L. Purvin

Process Economics
NG Plant Design
Distillation—Absorption
Refrigeration
Instrumentation

C. F. Sanderson

Petroleum Chemicals
Petroleum Chemistry
Refining Processes

C. R. Wagner

Petroleum Storage
Equipment and Methods
Vapor Saving
Devices and Methods

J. H. Wiggins

TECHNICAL FORUM MEMBERS

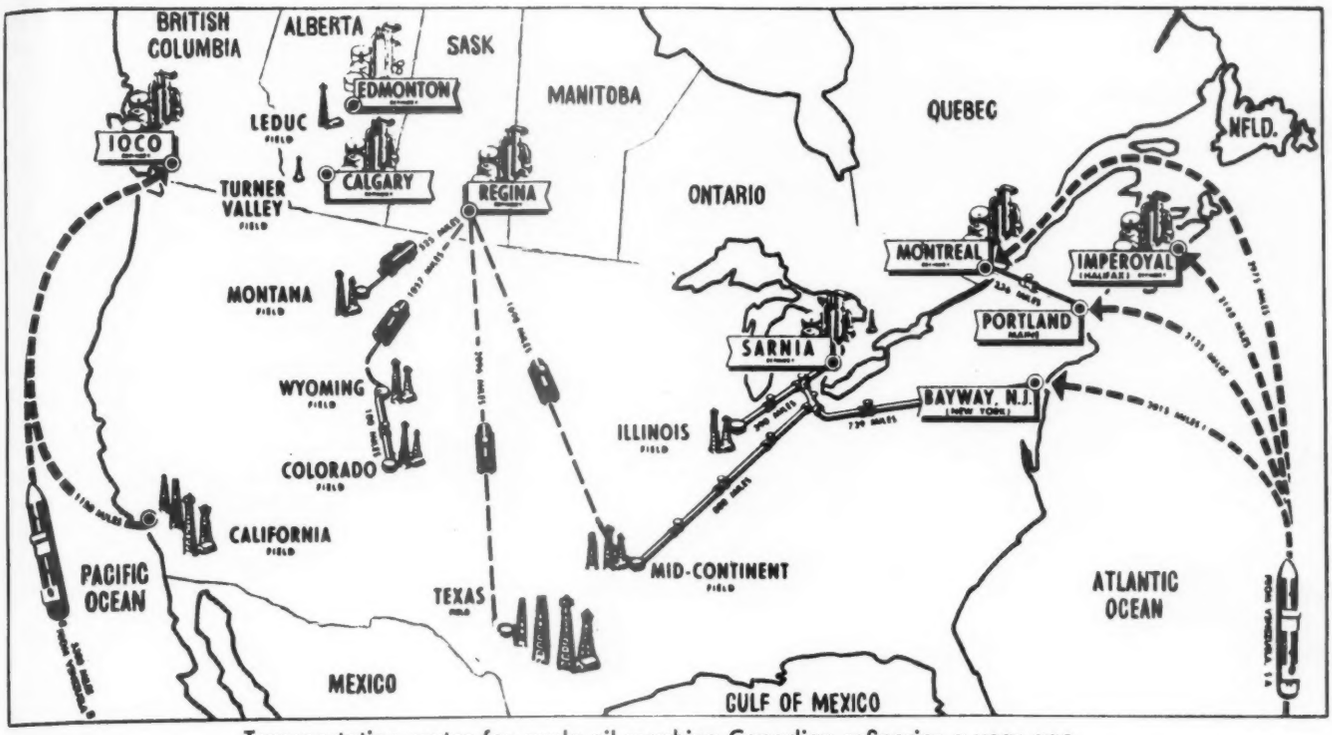
President of Alcorn Combustion Company, Frank H. Praeger is known wherever refiners and natural gasoline men do process heating in plants. Praeger graduated from the University of Pennsylvania in 1923 with a BS degree. He began work with the Public Service Company of New Jersey in plant operation and in combustion work. His work was with by-product coke ovens and water-gas sets, the old carburetted water gas or 'city gas' operations. In 1926 he joined the Alcorn Combustion Company, with headquarters in Philadelphia, Pennsylvania, went to the Southwest and became known widely throughout the oil and gas industries, first in the western area and as time went on, over many parts of the world.

Consulting engineer to the refining and natural gasoline industries, Robert L. (Bob) Purvin was granted a BA in chemistry in 1937, BS in chemical engineering in 1938 by the University of Texas. He obtained his DSc in chemical engineering from Massachusetts Institute of Technology in 1941, and began in Technical Service for Humble at Baytown immediately afterwards. He worked in light oil treating, lubricating oil refining, catalytic cracking and later was with the butyl rubber project. After the war's end he opened his consulting office in Dallas, and has been busy with a rapidly growing consulting practice and an equally rapidly expanding staff, specializing in gasoline plant design and operation, natural gas compression and transportation, petroleum economics.

A consulting and chemical engineer, Charles F. Sanderson is teamed with A. S. Glendening with offices in Houston, Texas. He is a graduate of Drexel Institute of Technology, with BS in chemical engineering. He worked with the Celanese Corporation in cellulose acetate research and in 1943 transferred to the Lummus Company. He was assigned to the Southwest as heat transfer engineer on aviation gasoline and synthetic rubber plants. He joined Petroleum Engineering, Inc. in 1945, received the Gulf graduate fellowship in chemical engineering at Texas A & M College, and obtained a MS degree. He was granted a PhD by Texas A & M in 1949, his thesis concerning oxidation of propane to yield petroleum chemicals.

Consultant on petroleum refining processes and chemicals, New York City, C. R. Wagner has a BS degree, 1915, and the honorary DSc degree 1945 from Wooster College, Ohio. In succession he was chemist with the Bureau of Soils, Washington, taught chemistry at Wooster, chemist with Standard of Indiana, managed Lion Oil Company's El Dorado, Arkansas refinery. He joined Pure Oil Company and became chairman of the refinery control board, 1939. He organized the process development section, PAW, 1942. Currently he is vice president in charge of operations for General Aniline and Film Corporation. He is on the Board of Governors of the Synthetic Organic Chemical Manufacturers Association.

President of John H. Wiggins Company, which he organized, John H. Wiggins has practically all his business and professional life been occupied with methods for conservation of light hydrocarbon products in storage. He received an AB from Leland Stanford University in 1911, a ChE degree in 1915. The Brazilian Government employed him for a year on irrigation projects and the U. S. Reclamation Service utilized his services for another year. He was on the engineering staff of the old Indian Territory Illuminating Oil Company; later worked with U. S. Bureau of Mines on research in storage facilities. Since 1922 he has engaged in the development of safe storage equipment for volatile hydrocarbons.



Transportation routes for crude oil reaching Canadian refineries a year ago.

Courtesy Imperial Oil.

Alberta Oil for Eastern Canada

H. G. COCHRANE

Americans are pioneers in the petroleum industry. They have shown the world how to transport oil and natural gas by pipe lines. More oil and gas flows through more steel pipe lines for longer distances in the United States than any other country in the world. But if present plans for cooperation between the U. S. and Canada reach the stage of implementation, an entirely new and unique Canadian way of carrying oil will evolve. Instead of being pumped through steel pipes from west to east, millions of barrels may be transported long distances merely by book entries; by a simple system of debits and credits.

Alberta Leads in Oil Hunt

Since 1946 oil discoveries in Alberta have been changing the aspects of the world's oil geography. Early in 1947, Canada had one major oil field, Turner Valley. Its production had depleted from its peak production of 11,000,000 bbl in 1930 down to a mere 6,000,000 bbl. Even with production from the other smaller Alberta fields added, the Province could scarcely supply its own needs. But rich finds since 1946 at Leduc, Redwater, Stettler, and Pincher Creek, together with continuing favorable developments in other existing fields, have already boosted potential production to five times what it was three years ago, with the addition of 50 or more new wells monthly holding promise of doubling this gain in a year's time. Reserves proved to date total close to a billion barrels.

Spurred by these recent discoveries, vast sums are being spent on finding more. This year the industry will spend some $100 million in the prairie provinces on exploration, development, and refineries, which is double last year's outlay, and four times that of 1947. Land under exploration, around 15,000,000 acres prior to the Leduc discovery, now exceeds 100,000,000 acres in Alberta and Saskatchewan. There are 88 or more geophysical parties in the field, most of them in Alberta. Some 130 rigs are drilling, half of which are on exploratory wells. Footage drilled last year exceeded 1,500,000 feet, double that of 1947 and four times that of 1946. Practically every producing oil company on the American Continent is represented in the hunt. Eighty per cent of the investment in exploration and developments is American money.

The province of Alberta owns most of the mineral rights. Last year a fifth of its total revenue came from the oil industry, and ultimately half its revenue may come from this source. The take for the current year may exceed $20,000,000, a tenfold increase over 1947. A single 640-acre section in the Redwater field was lately leased for $3,000,000.

Geological maps indicate that the

EXCLUSIVE

Output of Sarnia refinery—largest in the British Empire—has been increased to 53,000 bbl a day throughput. (Imperial.)

CANADIAN OIL REFINERIES,
Based on report by Dominion Bureau of Mines, December, 1948, with changes where later information is available.

Operator	Location	Crude oil capacity bbl/day	Type	Cracking capacity bbl/day
ALBERTA				
Imperial	Calgary	8,500	S.C.A.	4,000
Imperial	Edmonton	20,000	S.C.	8,000
British American	Calgary	6,500	S.C.A.	2,500
Gas and Oil Ref.	Hartell	2,000	S.C.	1,000
Husky	Lloydminster	7,500	D.A.	
Excelsior	Lloydminster	1,500	D.A.	
Vermilion Ref. Co.	Vermilion	1,200	D.	
BRITISH COLUMBIA				
Imperial	Ioco	12,000	Complete	2,750
Standard of B.C.	Burnaby	8,350	S.A.	
Shell	N. Burnaby	5,000	S.C.A.	3,000
MANITOBA				
Anglo-Canadian	Brandon	2,300	S.C.	1,100
North Star	St. Boniface	4,500	S.C.	1,800
Radio		700		
MARITIMES				
Imperial Oil	Halifax	34,000		
NEW BRUNSWICK				
N.B. Oilfields	Weldon	300	S.	
NORTHWEST TERRITORIES				
Imperial	Norman	1,100		
North West	Norman	850		
NOVA SCOTIA				
Imperial	Dartmouth	22,000	S.C.A.	9,900
ONTARIO				
Imperial	Sarnia	53,000	Complete	23,000
McColl-Frontenac	Toronto	12,000	S.C.	7,000
British American	Clarkson	10,000	Complete	4,400
Canadian Oil Cos.	Petrolia	4,000	Complete	2,000
Trinidad Leaseholds	Port Credit	5,000	Complete	3,000
Burlington	Hamilton	600		
British American	Toronto	14,300		
Goderich P.	Colborne	4,000		
QUEBEC				
Imperial	Montreal	37,000	S.C.A.	17,600
McColl-Frontenac	Montreal	40,000[2]	S.C.	29,500[2]
British American	Montreal	30,000[1]	S.C.A.	7,500[1]
Shell	Montreal	14,000[3]	S.C.	7,500[3]
SASKATCHEWAN				
Imperial	Regina	15,000	S.C.A.	8,000
British American	Moose Jaw	5,500	S.C.A.	2,500
Sask. Co-op.	Regina	2,000	S.C.	800
Hi Way	3 scattered	1,130	S.	

Type: S—Skimming. C—Cracking. A—Asphalt. D—Dehydration.
[1] Recently enlarged skimming capacity; added cracking and polymer capacity under construction;
[2] Being enlarged by 2000 polymer but had a bad fire;
[3] Being enlarged to 25,000;
[4] Being enlarged to 7500.

best prospects of finding oil on the prairies lie in Alberta or the Northwest Territories. Certainly the search so far has been more intense over these areas than further eastward. Yet this is probably not the only reason why comparatively little has been spent so far on exploration in Saskatchewan. The Socialist Government of that province has frightened away risk capital, while the neighboring provinces were encouraging it. But last winter the Saskatchewan government reversed its policy and embarked on a program to encourage oil exploration, offering exploration permits on terms even more liberal than in Alberta. Already permits are issued in Saskatchewan for exploration over 38,000,000 acres of crown oil and gas rights. Some exploration is also being done as far east as Manitoba.

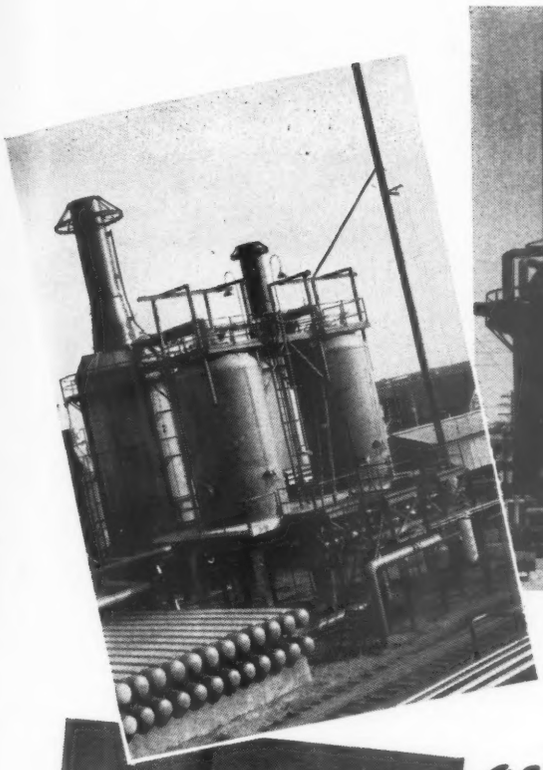
Production Outgrowing Prairie Market

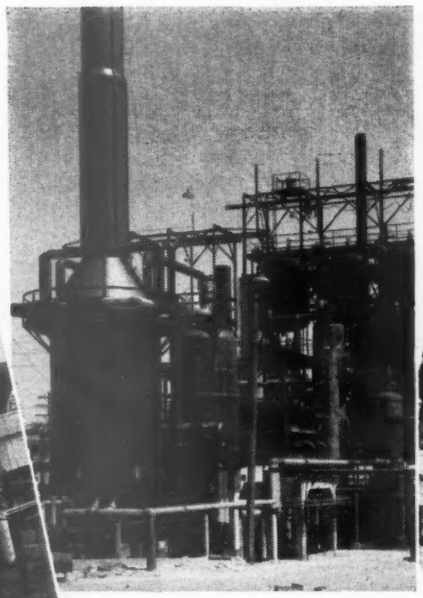
Eastern Canada produces an insignificant amount of petroleum. To oil and fuel their vehicles and their industry and heat their dwellings, eastern provinces are importing at the rate of 70,000,000 bbl of crude yearly, a third of which comes from the Continental U. S., the rest from South and Central American countries and the Middle East, most of it from Venezuela.

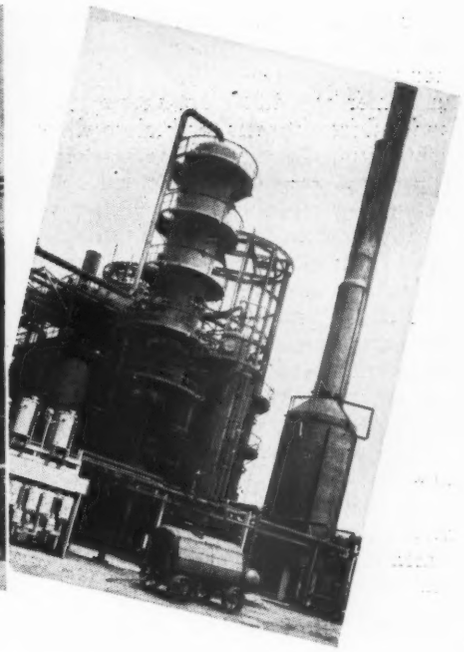
All Canada's domestic petroleum is produced in the provinces of Alberta and Saskatchewan in Western Canada. Production there has suddenly jumped from the low of 6,000,000 bbl in 1946, to double that quantity in 1948, will reach 19 or 20,000,000 bbl this year. It could be 30,000,000 with free flow, and, if the experts' forecasts are worth anything, to a possible four or five times the present rate by 1955, by the time adequate transportation to more distant mass markets permit the lifting of the present rigid proration, which keeps wells down to an average output, two-thirds or a half of what they could produce under safe conservation practice.

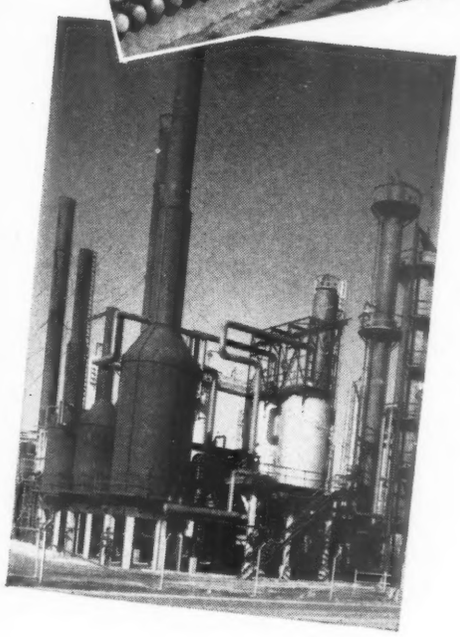
But more than enough is already being produced to satisfy the prairie market, for its predominantly farming economy. Much of the domestic heating there is done by natural gas. Thus, half a decade hence, if cheap transportation is available, and if proved reserves continue to multiply through new discoveries, the Canadian west may be supplying the western domestic market and have enough left to supply Ontario, and a surplus for export as well.

Little wonder then, that the industry should develop a violent attack of indigestion. With potential free flow









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production already passing the 90,000 bbl per day mark, domestic consumption varying between 40,000 bbl daily in winter to 65,000 bbl in summer, and rail freight rates too high to allow competition in distant markets and still rising, drastic proration has been imposed on all producing wells to give all a fair share and prevent ruinous price cutting.

That is why western eyes are all focused on pipe lines to reach more distant markets. The problem for Alberta is to keep exploration, drilling, refinery capacity, and transportation facilities in step. It is the old problem of the chicken and the egg. Further new discoveries are urgently needed to assure enough reserves to justify more pipe lines and more production, which in turn are the very incentives that are needed to spur exploration.

Prairie Potential Soon to Equal Dominion Consumption

Again assuming a continuation of present drilling progress, potential free flow production should catch up with total Canadian consumption by the middle fifties, estimated to reach 128,000,000 bbl annually by 1955, or 350,000 bbl a day. This of course means self-sufficiency in oil production for Canada, and assumes a tremendous increase in proved reserves to support such an output. No major new fields have been proved since the Redwater find a year ago, and from 8 to 12 more finds like Redwater are needed to support such withdrawals. For the average Canadian, this is far enough to look ahead.

Self-sufficiency in crude oil would not necessarily mean that all the refineries from coast to coast would use only Canadian oil for the production of their refined products. The most economic disposition of western oil in the continental pattern would appear to be by pipe into the north-central states, partly for export, partly on an exchange basis for U. S. oil deliveries to Ontario and British Columbia refineries, with Quebec and the Maritimes importing from Latin-American and other world sources as at present. In that event, self-sufficiency would mean that crude imports in some areas would be balanced by exports from the prairies. It would also imply that Canadian refining capacity would be kept in step with the rapid growth in the demand for refined products, and that is now being done.

Imperial has just completed an up-to-date 22,000 bbl refinery at Edmonton; McColl-Frontenac is spending $10,000,000 on a 5000 bbl plant, while British American Oil plans another one of 6000 bbl capacity, both at Edmonton. Independent companies are building additions at various points totalling 2500 bbl additional capacity. A $6,000,000 propane, butane, and natural gasoline recovery plant is planned at Leduc, and propane plants are being started at Calgary and Hanna, Alberta.

The Producing Fields

Let us briefly examine each of the major fields in turn, taking them in order of importance. Redwater, the latest major discovery, 35 miles northeast of Edmonton and covering an area about 9 miles long and 3 miles wide, has close to 156 producing wells; currently there are another 50 or so being drilled. Drilling takes only about three weeks. The pay zone is 3200 ft deep in a coral reef condition of the D3 zone, with no gas cap, with water underneath. Reserves are estimated variously at between 300 and 800,000,000 bbl, conservatively at from 30,000 to 40,000 bbl an acre. Here the pay zone is 140 ft, three times as thick as for Leduc, discovered in February 1947, the next in importance, and located 10 to 20 miles southwest of Edmonton. Reserves at Leduc, including the Woodbend area to the north, and the Golden Spike area to the west of it, probably add up to 300,000,000 bbl and cover an area some 15 miles long by 8 miles wide. Leduc's D3 zone is 38 ft with a thick gas cap and underlain by water. Though on an average it is estimated at lower productivity per acre than Redwater, ranging from 10,000 to 15,000 bbl an acre, the Golden Spike area is thought to be good for up to 125,000 bbl an acre. In the Leduc area there are some 300 producing wells, with another 25 or so drilling.

These two fields and the surrounding area constitute one of the major strikes on the continent over recent years. Edmonton city, which lies astride a line joining them, hardly knows whether to hope or fear these two fields will connect. A well in the backyard of somebody's city lot, if it got out of control and caught fire like the Atlantic No. 3 wild well did a year

Calgary refinery successfully met unusual demands resulting from a late spring and from floods.

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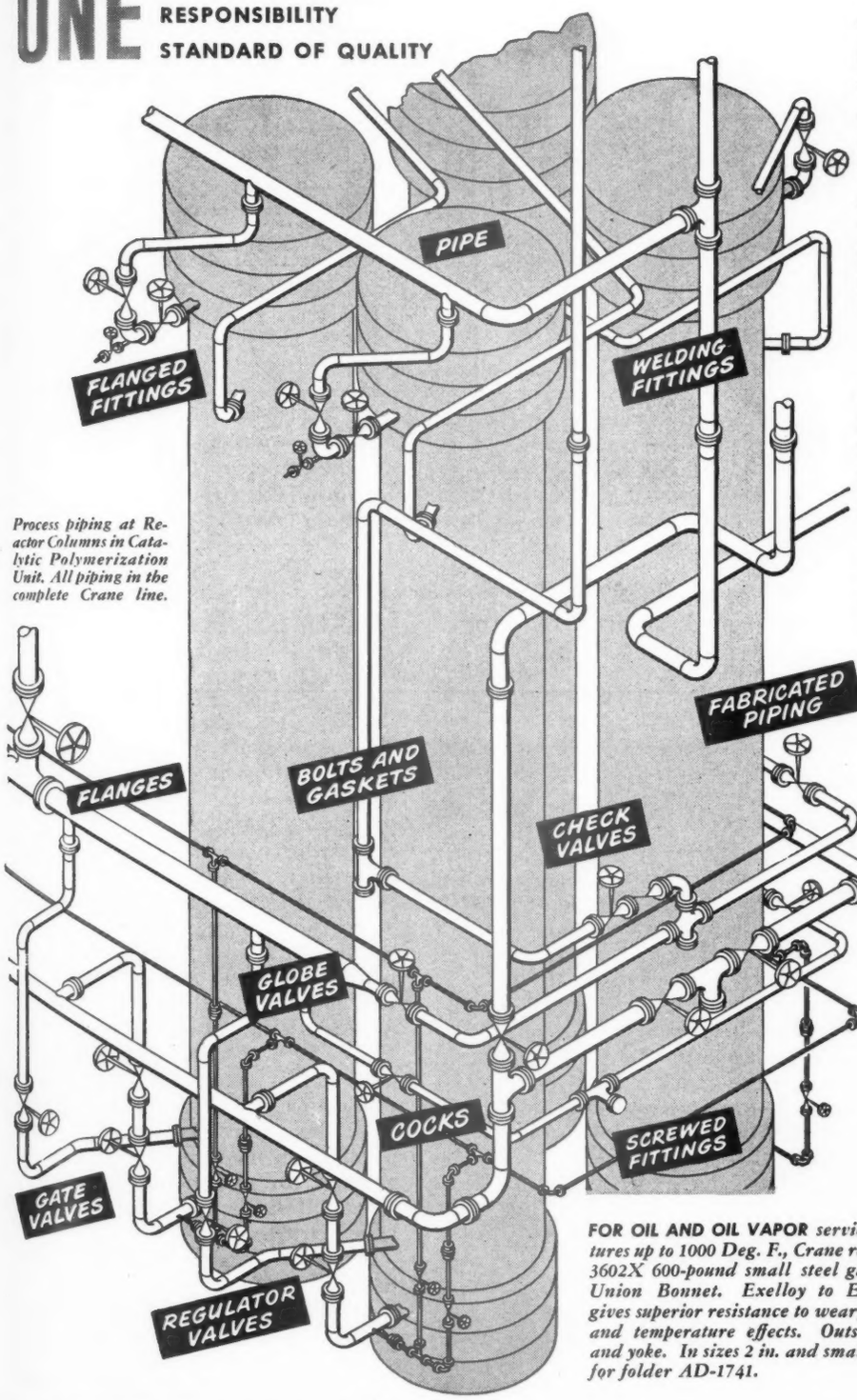

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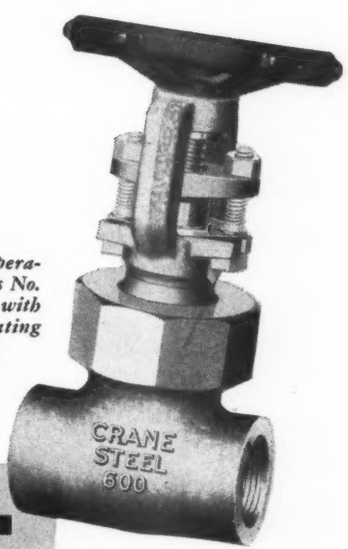

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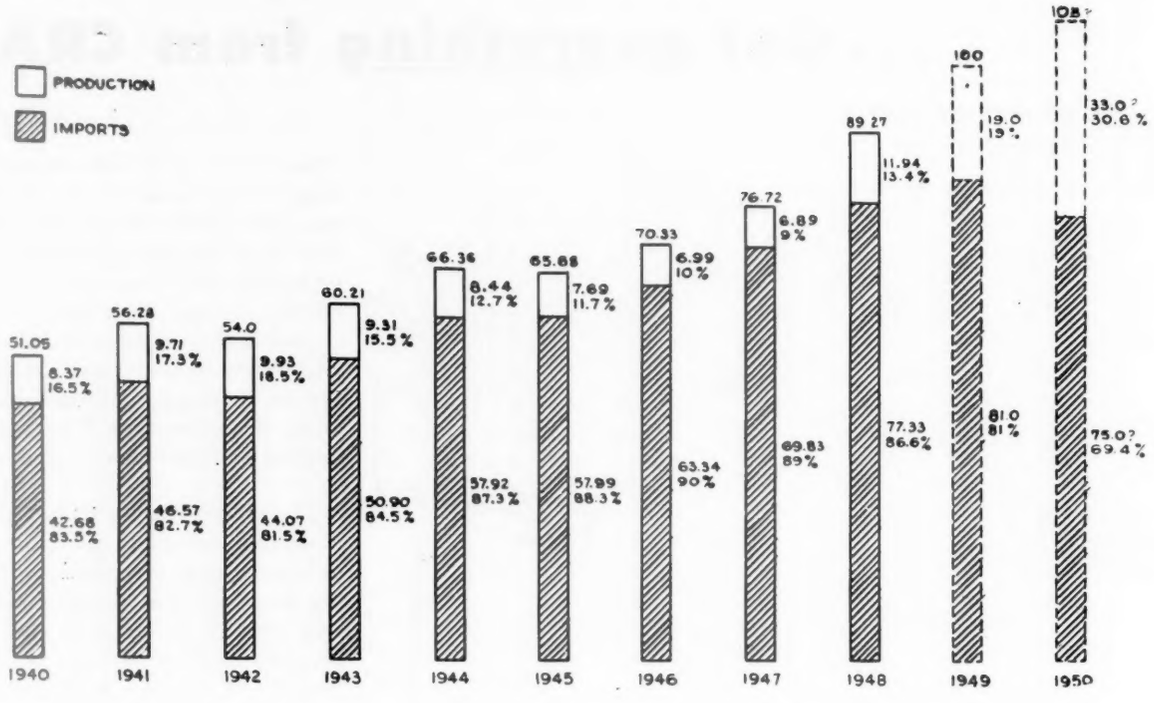


Crude oil deliveries to Canadian refineries by years 1940-1950 in millions of barrels—showing rise in proportion of domestic production.

ago, would rapidly reduce the city to an ash heap.

Turner Valley, the first big discovery, which came into prominence in the middle "thirties," is 30 to 40 miles southwest of Calgary. Reaching peak production in 1930, its output has now depleted to about four million barrels yearly. Here there are close to 400 wells, 307 of them producing, and a few new ones are still drilling.

All the aforementioned fields produce light oil varying between 35 and 45 deg gravity, with paraffin base. Most of it except Redwater oil is sweet. The next in importance to date, however, the Lloydminster field, is just east of the Alberta boundary, in the province of Saskatchewan, and produces heavy black oil of 25 to 35 deg gravity, with an asphaltic base. Production is scattered over a 200,000 acre area, was less than 900 bbl daily three years ago, and this year has varied between 100 and 6000 bbl daily. Proved reserves stand at 35,000,000 bbl, with potential estimated from 3 to 10 times as much, from the 2000 ft deep cretaceous sands.

Other smaller producing fields are at Princess, Taber, Conrad. Current production from these and several smaller fields, under severe proration, stands at some 2500 bbl daily, as compared with a daily output of 20,000 bbl from Redwater, 26,000 from Leduc-Woodbend-Golden Spike, 10,300 from Turner Valley, and 5300 from Lloydminster.

Other Fields—Future or Remote

Two recent discoveries of importance are at Pincher Creek and Stettler, both sponsored by Canadian Gulf Oil. The former followed a million dollar geological and geophysical study of this foothill region, which is in the southwest corner of the province. Two wells of some 12,500 ft in depth have brought in as successful wet gas producers with open flow of 44,000,000 and 83,000,000 ft of gas and 1500 and 3000 bbl respectively daily, of 52 deg gravity distillate from the Madison lime. Drilling is continuing, but wells are capped until there is a market for the oil and the gas. The Stettler discovery, northeast of Calgary, came in last May, from the Devonian D2 zone at depth of 5200 ft. First wells have shown 3000 bbl daily flush flow of 28 to 32 deg oil from the D2 and D3 zones, with up to half a million feet of gas daily. An earlier test showed 1500 bbl free flow from D2 zone only. More wells are drilling.

Two other fields should be mentioned in passing. The first of these is at Norman Wells, with proved reserves of 36,000,000 bbl, down the Mackenzie river close to the Arctic Circle. This is the field that was developed during wartime to supply a refinery at Whitehorse in the Yukon, by way of the famous Canol pipe line.

Sixty-three wells were drilled, and the refinery briefly produced for a year at the rate of 3000 to 4000 bbl daily. Now the pipe line is partly dismantled and what is left is in disrepair. The refinery was knocked down and moved out by truck over the Alaska Highway two years ago, and set up by Imperial in Edmonton as part of their present refinery. Present production supplies a small refinery of 1100 bbl daily capacity at Norman, which meets the local requirements as needed for the mining industry around Yellowknife and Great Bear Lake, partly by pipe line.

The second is the McMurray Tar Sands around the Athabasca River at Fort McMurray, 300 miles north and east of Edmonton. Here is a potential supply of petroleum to last America upwards of 50 years, possibly 100 billion barrels, if suitable and practical methods of excavating the sands, separating the tar from the sand, and of getting the oil to market, could be developed. Both the Dominion and Alberta governments have assisted the companies interested through research and development, but the tar sands still remain an enigma.

Bigger Outlet Needed

Proration is a negative approach. Something had to be done to maintain hopes for the wider market, on which exploration and development feeds. Producers felt it was preferable to use funds for outlets rather than spend them all on premature drilling. More than a year ago Imperial Oil, Canada's largest producer, began to lay plans for a 450-mile pipe line from the Leduc Field to refineries at Regina, to carry 40,000 bbl daily. A bill to incorporate a subsidiary pipe line company as a common carrier, to be known as Interprovincial Pipeline Ltd. was given approval by the Canadian House of Commons at its last session. With further discoveries at Redwater, and the extension of the Leduc-Woodbend field to include the fabulous Golden Spike discovery with its 564 ft of porosity and 10,000 bbl daily free flow in its first success, Imperial Shoepp No. 1, it rapidly became necessary to keep raising their sights to keep in step with potential production.

The next idea was to extend the pipe line to supply Winnipeg, and to continue to Lakehead at Fort William. This had been visualized more than a decade ago when Turner Valley was booming. Studies at that time disclosed that to make it economically possible to supply Sarnia by pipe line to Lakehead at Fort William and thence by tanker, a 70,000-bbl throughput was necessary to attain low enough pipe transportation charges so as to permit competition with Illinois oil delivered at Sarnia. But proved reserves fell far short of being sufficient to justify the project, and it was abandoned.

New plans have been thought up over the past 18 months. One such plan visualized a pipe to Winnipeg and thence to some Dakota point like Bismarck, where a refinery would be built. About this time, however, hints of opposition to Canada exporting oil to the U. S. appeared in Congress, and eyes were again turned to the eastern Canadian market.

Reaching the Eastern Market

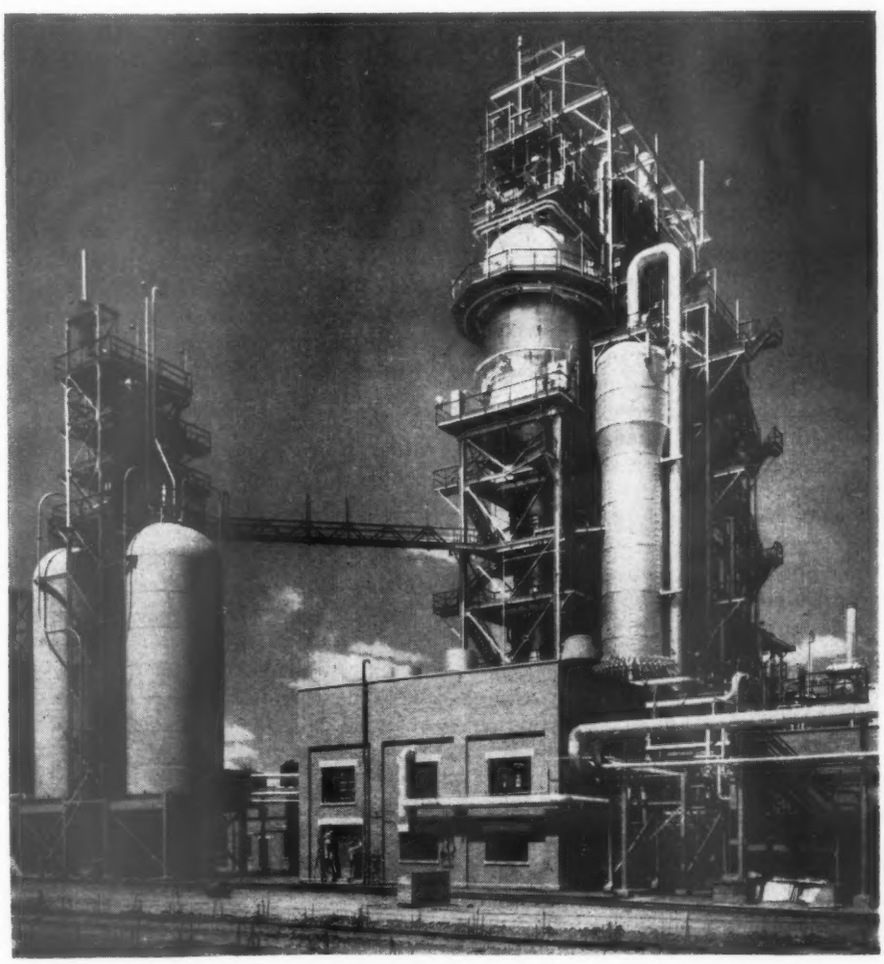
In September of this year, H. H. Hewetson, president of Imperial Oil, announced that the 450-mile line already under construction from Edmonton to Regina would now be extended to the head of the Great Lakes. It would be licensed as a common carrier. Starting at Edmonton, it would pass close to Kindersley, Saskatchewan, then between Moose Jaw and Regina, feeding refineries at both these points, and cross the Manitoba-Minnesota boundary at Gretna, south of Winnipeg. A short branch might feed into Winnipeg also, where Imperial is considering building another 6000-bbl refinery. From here the line would pass through a sedimentary area to Superior, Wisconsin, on Lake Superior, a total distance of some 1150 miles from Edmonton to the Great Lakes, at a total cost of some $90 million. Parliament has approved it as far as Regina, though approval from there to Superior must be obtained south of the boundary from the Interstate Commerce Commission.

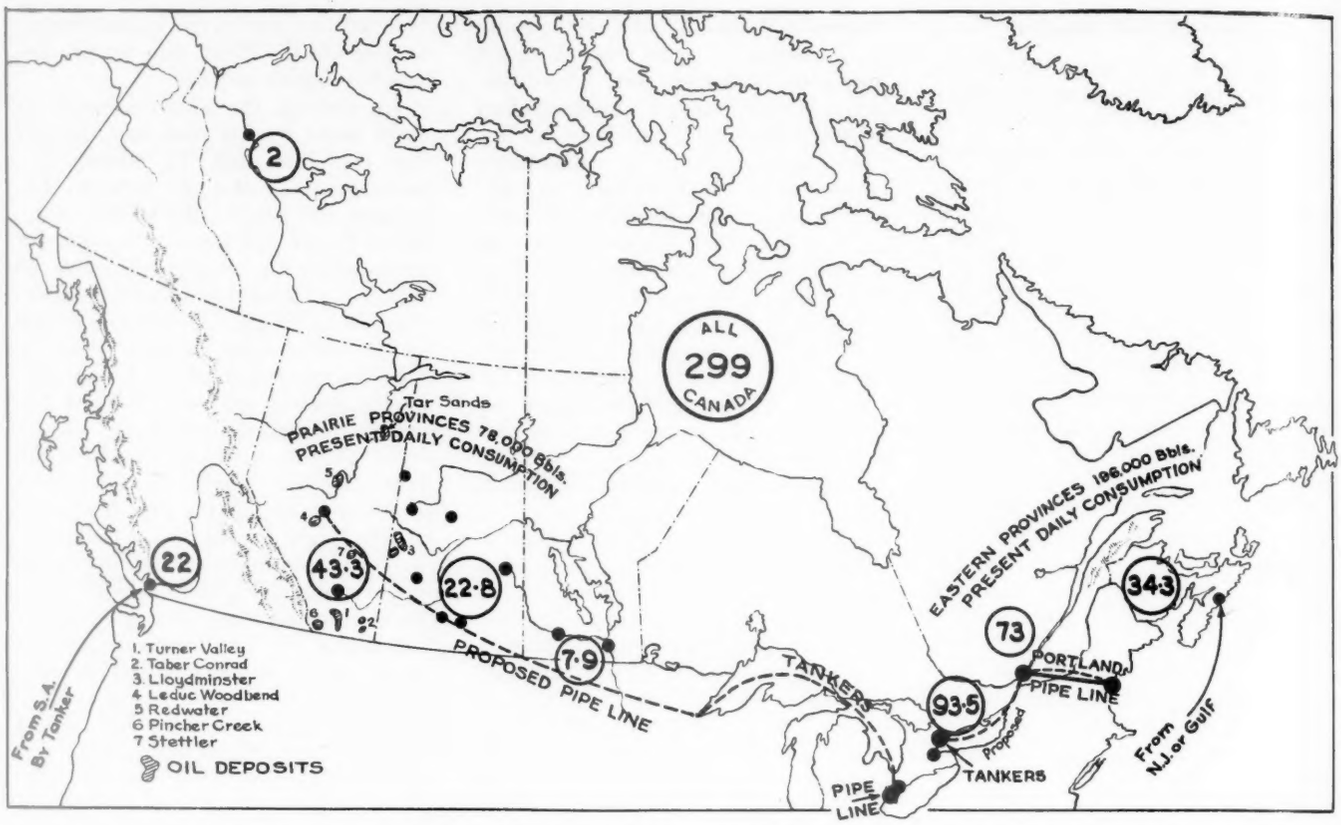
There would be six pumping stations, two of which would be between Edmonton and Regina. The first stretch to Regina would be 20-in. pipe, with 16-in. pipe from Regina to the U. S. Boundary and 18-in. from there to Lakehead. The 80,000 tons of 16-in. pipe originally proposed for the first 450-mile leg to Regina is already being manufactured in Welland, Ontario. This will now have to be laid on the stretch east of Regina. The 18-in. pipe for the section between the Boundary and Lakehead will have to be manufactured in the United States, as also will the 20-in. pipe for the Edmonton-Regina section.

In making the announcement of these plans by his company, Hewetson explained that by adding two more pumping stations between Edmonton and Regina, the initial capacity of 95,000 bbl per day needed for Saskatchewan refineries could be raised to 136,000 bbl daily. Oil deliveries to Regina would commence by the fall of 1950, he said, while the pipe would be completed by the following spring into the Port of Superior, Wisconsin, across the harbor from Duluth. It was necessary, he cautioned, that further reserves must be found to enable the pipe line to be of maximum benefit to the industry, since only by maintaining a high load factor and keeping the line full of oil, could transportation charges be kept sufficiently low to permit competition at points of delivery with oil from other sources.

It is planned in the initial stages that summer deliveries into Superior would average 60,000 bbl daily, drop-

Canada's first fluid catalytic cracking unit (below) went into production in August, 1948, at Imperial's Montreal East refinery.





Daily refinery capacity for crude oil (in Canada) shown in thousands of barrels for each province or region positions of principal refining centres also shown by black dots.

ping to 10,000 daily in winter months, thus flow would average 35,000 bbl daily throughout the year, to be shipped by tanker to Sarnia at the rate of 60,000 bbl daily over the 7-month season of open lake navigation. The oil would be taken out of the pipe line at Superior in bond, and unless destined for delivery at U. S. refineries, no customs charges would be involved.

To make Edmonton area crude competitive in Eastern markets, it will be necessary to reduce the present wells price. This is justified by the large production surplus to actual prairie requirements for which the market is obtained by pipe line, which is more desirable than limiting production to prairie requirements at a higher price determined by competition from alternative supplies in the area.

The tariff structure for the pipe line has not been finalized. This depends on the actual investment and various other factors. Using Sarnia as an example of the ultimate market, the price of comparable Alberta crude is determined by the laid down cost at Sarnia of crude from the Mid-Continent area, less the lake tanker freight from Sarnia to Superior, less terminalling charges at Superior, less the pipe line tariff from Superior to the point of origin, less gathering, handling, and transportation charges involved from the field to the pipe line terminus.

Exchange Agreement

N. E. Tanner, acting premier of Alberta and Chairman of the Alberta Petroleum Conservation Board, predicted in Calgary about the same in an address before the Kiwanis Club, that a petroleum exchange agreement might shortly be signed between the United States and Canada. Under such an agreement, U. S. refineries would purchase oil at Lakehead, while other U. S. producers in the United States would deliver like quantities to Eastern Canadian refineries, thus saving a considerable drain on Canadian holdings of U. S. dollars, as well as a further outlay for lake transportation charges. This, he explained, would only occur after the pipe line was completed to the Lakehead. If such an agreement could not be reached, shipment of Alberta oil through to Sarnia by tanker could only be made at a greater cost. He felt, however, that there were grounds for believing that U. S. authorities would cooperate. Such an arrangement would tend to overcome objections on the part of certain U. S. interests who presently oppose the importation of Canadian oil, and accuse Canada of trying to invade the U. S. market.

Meanwhile, several larger Canadian producers, Shell, British American, and McColl-Frontenac are working on the idea of a 350-mile 12-in. pipe line between Montreal and Toronto, to be known as the Queont Pipeline Company, to cost between $15,000,000 and $20,000,000. This project also received a blessing by Parliament last spring. Its purpose would be to supply refineries in the Toronto area with South American oil that presently reaches Montreal by pipe line from Portland, Maine, or direct by tanker during the navigation season in the St. Lawrence river.

It would thus reduce the necessity for importing 7,000,000 to 10,000,000 bbl of oil from United States sources yearly across the Great Lakes, saving Canada an annual outlay of some $25,000,000 of U. S. funds. Less has been heard of the plan lately, perhaps through difficulties in obtaining pipe, more probably because by 1955 some oil may be flowing as far east as Toronto as well as to Sarnia from Alberta sources, leaving too short a time to amortize the cost of the pipe line. Coupled with this is a plan to lay a second pipe alongside the present line from Portland to Montreal at a cost

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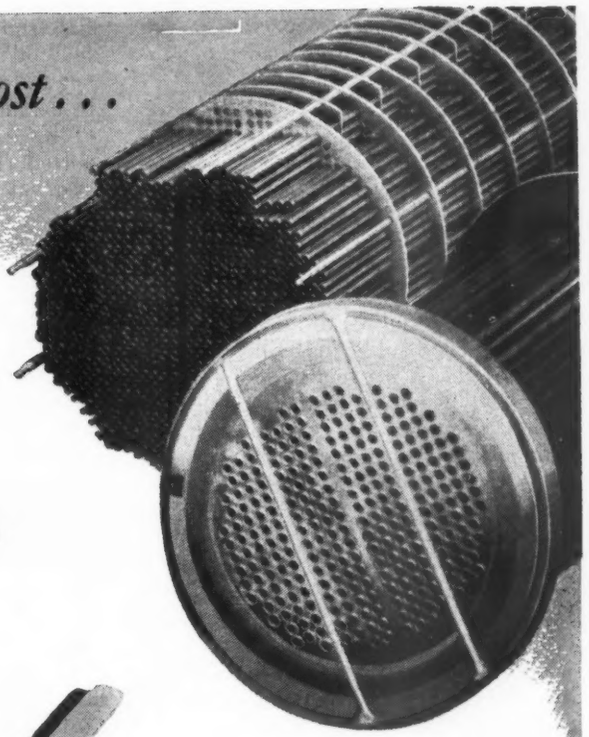

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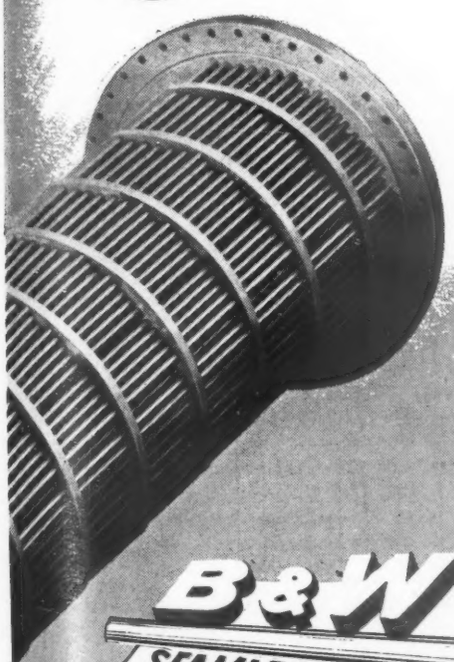

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of $15,000,000 the capacity of the existing line being fully loaded to supply Montreal.

Modern and Flexible Refineries

Refining methods vary widely across the Dominion to suit diversified markets and different sources of crude. Coastal British Columbia is isolated from the rest of Canada so far as oil is concerned. Local consumption, standing at a little more than 8,000,000 bbl of refinery products yearly, is predominantly a gasoline and heavy fuel oil market. The heavy fractions are largely used for bunkering, the lighter and medium fuels being needed in smaller quantities due to the popularity of "hog fuel" or baled sawdust. All their crude comes from California by tanker. Rail rates of $1.35 a barrel on oil across the mountains on Alberta oil are prohibitive, and studies have been made by Imperial of the possibility of a pipe line to carry it to Vancouver, which show a possible transportation cost of 50 cents a barrel. The Alberta oils, however, are situated east of the mountains in an area of relatively higher prices and would have difficulty in competing with world prices at an ocean port. Refineries at the coast are not modern and are less flexible than other Canadian refineries, and could not treat the light Alberta oils economically. There would either be a surplus of gasoline that would have to be exported, in peacetime at least, to Pacific Northwest States, or a deficit of heavy fuel oil that would have to be imported as such from refineries in the United States.

On the other hand, light Alberta oil is perfectly suited to the local prairie market, which wants gasoline and lighter fuel oils, has little use for the heavy fuel oils. Here, easily obtained natural gas and native coal provide the bulk of the heating requirements. Most of the Alberta fields produce oil of more or less similar gravity, and there is little change from year to year in the proportions of gasoline and light and medium fuel demand. Refining capacity in the prairie provinces is presently well ahead of local requirements, and most of the refineries are modern and up-to-date.

The Ontario refineries, which process about a third of all the crude used, import U. S. oil by pipe line and lake tankers, have experienced a rapidly expanding market for light and medium fuel oils over postwar years. Quebec refineries center at Montreal, and import South American oil, mostly from Venezuela, direct via ocean tanker or by tanker and pipe line from Portland, Maine. The Quebec fuel oil market, though growing, is not so large as in Ontario. Variations in demand can be readily taken care of by varying the types of oil imported. Refineries in the Maritimes also get South American crude, and have a considerable shipping market to serve with bunkering oil.

Eastern refineries in general have been improving and adding to their facilities and storage, so they have more flexibility to supply variable markets for their products, and more adaptability for using crude from other sources. Even Montreal refineries would be glad to get western oil, if cheap transportation could assure a low price. It has a high gasoline content and the biggest market is, after all, for gasoline.

Distribution

The choice between rail or tank truck haul for distribution from refineries depends on local situations. For Central British Columbia, the highways through the mountains make long haul difficult. Coastal B. C. has to be supplied by tanker. Gasoline distribution lines were laid over part of the Alaska highway north to Fairbanks and south as far as Watson lake from Whitehorse, when the road was built. Since the refinery was dismantled three years ago at Whitehorse, ocean tankers deliver gasoline to storage tanks at Skagway, from where a 4-in. pipe line feeds it into the pipe distribution system along the highway. U. S. army supply officers would like to see gasoline piped along the Alaska highway north from Edmonton. Gasoline is shipped by rail from Edmonton to Waterways, where it is loaded in drums on river boats for the Yellowknife Gold Mining area on Great Slave Lake and other points as far north as Norman Wells.

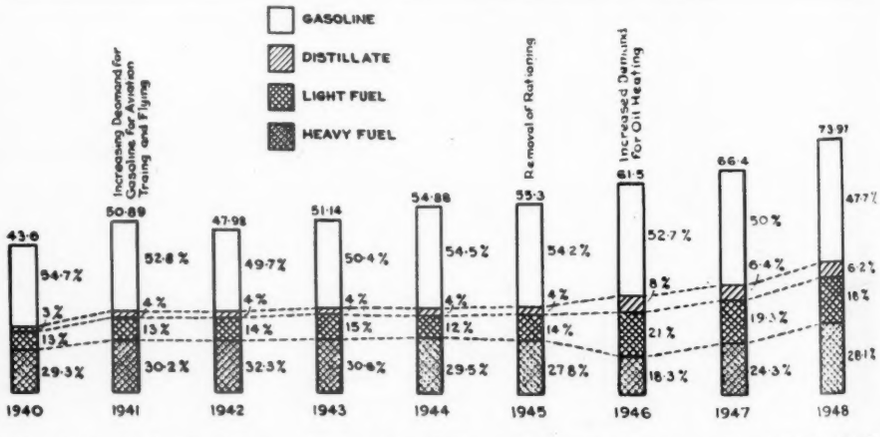
Distribution on the prairies is mainly by rail in east-west directions, while north-south shipments are frequently cheaper by tank truck since highway communications north and south are more convenient than rail lines. Often it is impossible to keep prairie highways open during winters of heavy snowfall.

River, lake, and coastal tankers are able to do considerable bulk distribution in the central provinces to central points or ocean ports where tank trucks take over. Tankers go up the Ottawa river in summer as far as Canada's capital. Some few outlying centers in the north country have to be supplied by rail, but more remote centers in the far north get deliveries by air, or in drums by annual ocean sailings from Montreal to Hudson Bay in the summer.

Distribution for the Maritime provinces is mainly made by coastal tankers that deliver to points of distribution established along the coasts. Tank trucks take over from there. Newfoundland is served in much the same way, as most of the habitations are fishing villages along the coasts. Inland settlements are served in some cases by rail as highways are poorly developed. Goose airport is fed by ocean tankers to a nearby dock in an inlet and trucked the last few miles.

Natural Gas

The main objective of past and current exploration in Alberta has been the discovery of crude oil. More or less accidentally, that oil search has brought discovery of tremendous reserves of gas. In total, Alberta's proved and probable gas reserves add up to at least 4000 billion cubic feet, and some estimates range to over



Production of saleable products from all Canadian refineries by years 1940-1948 in millions of barrels—showing growth in proportions sold as light fuel oils.

NOTE: *It will be noted that since most of the fuel oil is used in Ontario, where about a third of the crude is refined, that in Ontario the actual increase in use of light fuel oil will be much greater than shown by the chart, while the other provinces will show little change.*

5000 billion. In the opinion of most geologists, these reserves are just a drop in the bucket to the reserves that could be established in Alberta, if there were a logical reason for spending the money to find them. At present, no such reason exists, for the bulk of Alberta's population and industry is now served with gas, and export of gas is currently forbidden.

Back in the late war years, at a time when there was grave concern about a shortage of crude oil to meet the prairie demand—some major oil companies began thinking about synthesis of natural gas to obtain synthetic petroleum products, and found some new sources of natural gas at Viking-Kinsella, a 50,000 acre gas reserve which supplies Edmonton and Central Alberta towns. They turned it into a reserve covering about 300,000 acres, good for around 1000 billion cubic feet.

Shell Oil has proved up and capped another 1000 billion feet at Jumping Pound west of Calgary. Canadian Gulf is sitting on top of another hundred billion foot field in the Pincher Creek area.

Lately applications have been received for exporting natural gas to Winnipeg, as well as to Vancouver and Northern Pacific cities such as Spokane, Seattle, and Portland. A Natural Gas Commission last winter made an exhaustive study on whether export should be permitted. Though the Alberta government apparently intends to move cautiously in granting permits for export, Premier Manning stated last May that "with Alberta's ever increasing gas reserves, the time may well be at hand when it will be not only feasible but advisable to allow the export of gas, at least to neighboring provinces." Speaking again in July he said that although presently not satisfied that gas reserves are adequate for export, this did not mean that export projects were ruled out.

Objectives Not Different

Canada's immediate interest in these vast and rapid oil developments is a reduction in the outlay of scarce U. S. dollars for imported oil. In 1947 she spent over $120,000,000 on U. S. oil, last year about $100,000,000. Before many years pass, U. S. dollars may begin to flow northward for net imports of Canadian oil. That would tend to balance trade, and save dollars to allow a wider market in Canada for other U. S. products such as fruits, vegetables, textiles, and automobiles, so this would not represent a loss to either country.

But the longer term interest ties in with defense planning, and here Canada and the United States have very definite interests in common. Prior to the war nearly all the world's exportable oil came from the United States. Today the Middle East can export more than North and South America combined, and the Middle East is vulnerable to attack. But with what Canada is now expected to produce five years hence, Canada and the United States together will come close to matching Middle East exports. Today the U. S. is not quite able to meet even her own peacetime needs, though she is producing more oil than ever before. Last year, for the first time in history, the U. S. was a net importer of oil. A third world war, if it came, might call for two or more million barrels of oil a day for the Armed Services. Much of this could be obtained by imposing very severe restrictions on civilian use. U. S. defense planners predict the average civilian will get only half as much gasoline under rationing as he did during the last war. How much more comfortable would it be for both the U. S. and Canada if these western Canadian oil fields should turn out to be another "Texas"—big enough, added to what we already have, to make this hemisphere self-sufficient in oil, in peace or war!

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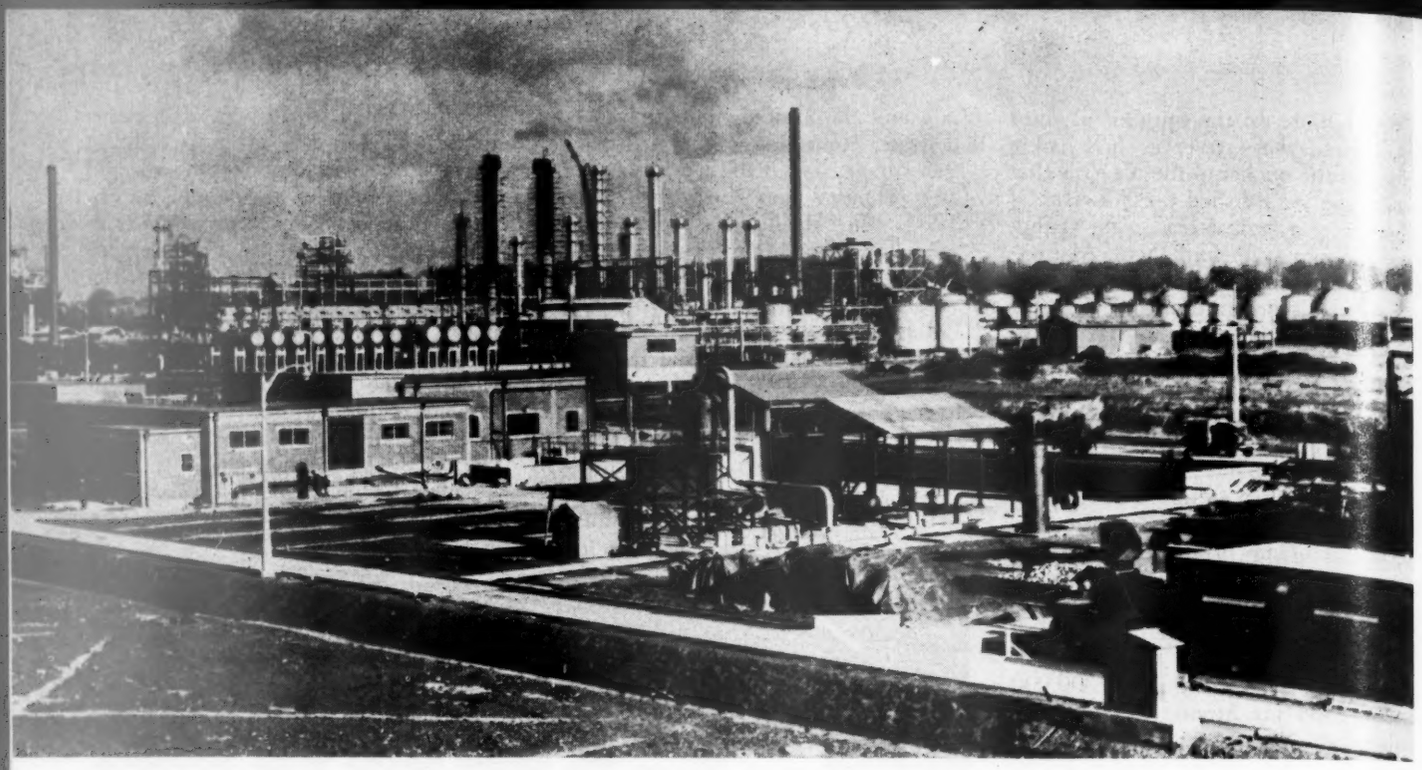

Shell chemical plant and tank farm, Stanlow, England.

P 739.23

Making Chemicals in Stanlow, England

ARCH L. FOSTER*

THE new plant of the Shell Chemical Manufacturing Company, Ltd. is situated at Stanlow, near Ellesmere Port, on the Manchester Ship Canal. It is adjacent to the existing Stanlow refinery, and the new Shell refinery now under construction. When the whole scheme is completed it will occupy an area of 1800 acres.

The plant was originally designed as an independent unit, to produce 24,000 tons per annum of solvents by the pyrolysis of gas oil. Once the new refinery is completed, however, the solvents will be manufactured from the gas produced during normal refinery operations, thus making the whole an integrated process, starting from crude oil and ending with petroleum chemicals.

The new chemical plant is part of the greatly expanded manufacturing system built and building at Stanlow. Shell Oil interests have had the old refinery in operation for a number of years, near by. This plant is credited with a daily capacity of 16,700 bbl per day of topped crudes and different distillates. These unfinished products are processed into lubricating oils and asphaltic materials for English and European consumption. In addition a new refinery is under construction alongside the chemical plant site, an installation rated to refine 2,500,000 tons per year of crudes, mainly or entirely of Middle Eastern production. When this new refinery is in operation with cracking and other modern facilities it will supply most or all of the raw gases, olefins mainly, needed by the chemical plant, which then can eliminate the cracking step on gas oil or other heavy oils to make the charge stock for its units. The old refinery is not provided with cracking facilities, and therefore has little if any gaseous products to supply the chemical units.

These new developments are a part of the worldwide program of the Shell interests in which more than $400,000,000 is being spent, financed entirely by the company. As is to be expected the great proportion of the equipment in these plants was obtained from British manufacturers and shipyards. Of the total, about $260,000,000 is said to have been spent in the United Kingdom. The chemical unit is 97 per cent British-built, according to recent advices.

The Stanlow Plant has been designed for a maximum of automatic control and thus, while it will make a relatively small demand on the country's labor force, it has necessitated a very high capital expenditure for specialized instruments and equipment embodying the latest advances in petro-chemical technology.

No detailed information is available as to the various units included in the chemical plant. These include, however, the primary thermal cracking unit, which converts gas oil or other heavier fractions into cracked light products, especially ethylene, propylene, and butanes. Also included are reactors and convectors along with fractionation, dehydrogenation, polymerization and synthesis equipment to yield the different solvents to be made. It is claimed that products of 99-plus per cent purity are being

*Refining Editor.

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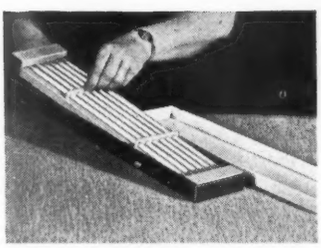
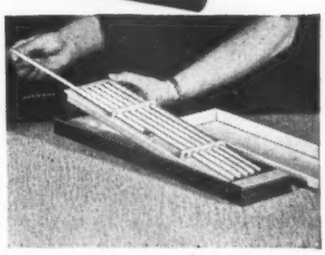


To remove thermometers, simply raise end of box platform.



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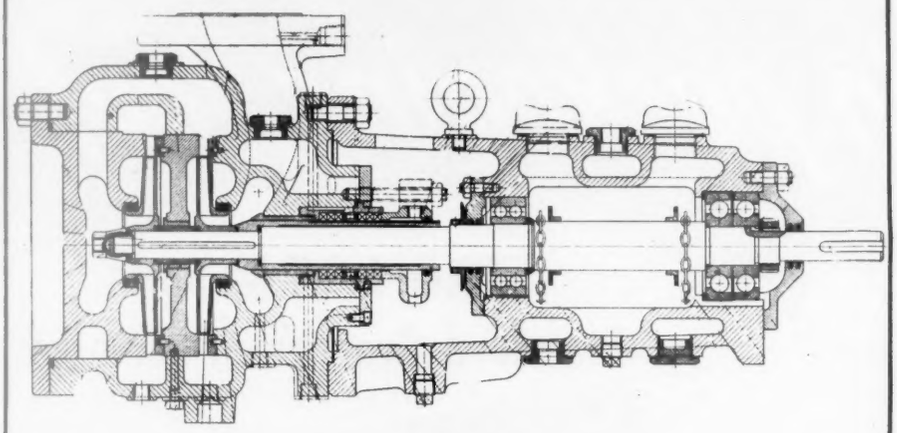


FIG. 2. Sectional view of typical two-stage pump.

made and that practically any solvent known can be made in this plant.

The chemicals produced, apart from their solvent use, have a wide application in synthesis in industry and are processed from petroleum gases that not many years ago were useless refinery by-products. These gases result from "cracking" oil at high temperature and low pressure and the aim is to produce fractions containing three or four carbon atoms. Propylene is the three-carbon compound in the lighter fractions and it is reacted with sulphuric acid. The resulting alkyl esters are converted to isopropyl alcohol, which, in turn, becomes the basis for many other chemicals. The C_4 fraction, after treatment to remove unwanted constituents, gives butylene and butane, the former, in turn, yielding secondary butyl alcohol and methyl ethyl ketone. The initial range of solvents from Stanlow will be:

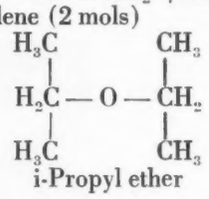
Isopropyl alcohol, isopropyl ether, acetone, diacetone, methyl isobutyl ketone, mesityl oxide, secondary butyl alcohol, and methyl ethyl ketone.

In general, the chemistry of these syntheses is simple, but the technology and technique sometimes offer serious difficulties to the chemical engineer. Cracking of the heavy oils is so controlled, based on experience and on experimental work, that a maximum yield of propylene and butenes is obtained. For producing isopropyl alcohol from potpylene, it is necessary to add a molecule of water, that is, to hydrate the olefin;

$$\underset{\text{Propylene}}{CH_3-CH=CH_2} + \underset{\text{Water}}{H\text{-}O\text{-}H} = \underset{\text{i-Propyl alcohol,}}{CH_3CH(OH)-CH_3}$$

in which reaction a catalyst is employed. The simplest reaction to produce isopropyl ether from propylene is by the addition also of a molecule of water to two olefin molecules;

$$\underset{\text{Propylene (2 mols)}}{2\ CH_3-CH=CH_2} + H\text{-}O\text{-}H =$$



i-Propyl ether

Similarly, other products are made, for which industrial and commercial demand in Britain and the Continent is high and increasing steadily as Europe gains momentum in its recovery drive. Most of these processes require catalysts, such as sulphuric acid, oxidation, and hydrogenation or dehydrogenation catalysts.

To circulate all these liquids from one place and section to another and through stills, tanks, columns and heat exchangers, after prolonged discussions about design, features and materials, an order was placed for well over 250 Sigmund centrifugal pumps, covering the majority of all pumping operations in the new plant. (Fig. 3).

Some of the liquids are extremely volatile, other toxic; many are pumped at high temperatures (some above 600 F); and again some are very expensive, costing in some cases over $2 per gallon. All kinds of liquids, from propanes and butanes to viscous fuels must be handled. These conditions demand extreme reliability of the pumps throughout, but especially of the shaft sealing member, in order to reduce leakage to an absolute minimum.

The large number of pumps involved created a considerable maintenance problem, as it seemed quite out of proportion to have a spare pump available for each duty, as is often done in refineries. To deal with all these aspects, all the duties to be performed were tabulated and then grouped. Thus, 3 basic pump designs were selected; a single-stage pump, a two-stage pump and a multi-stage barrel pump. Within these groups steps were taken to keep variations of

FIG. 3. Pumping station, horizontal branches.

ACCESSIBLE ARRANGEMENT OF INTERIOR PARTS

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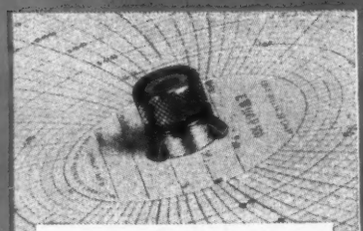

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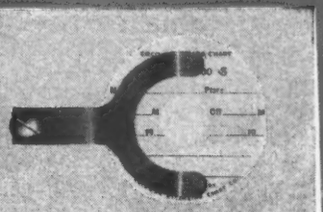

CHART RANGE TAG

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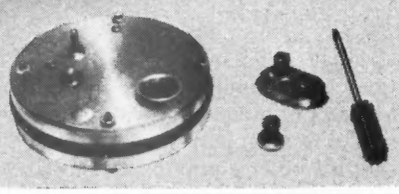

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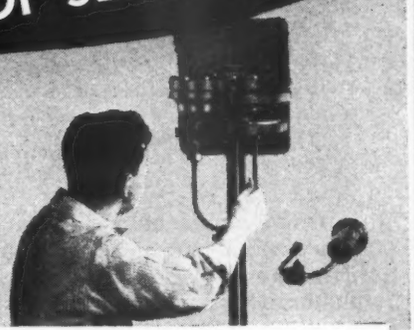

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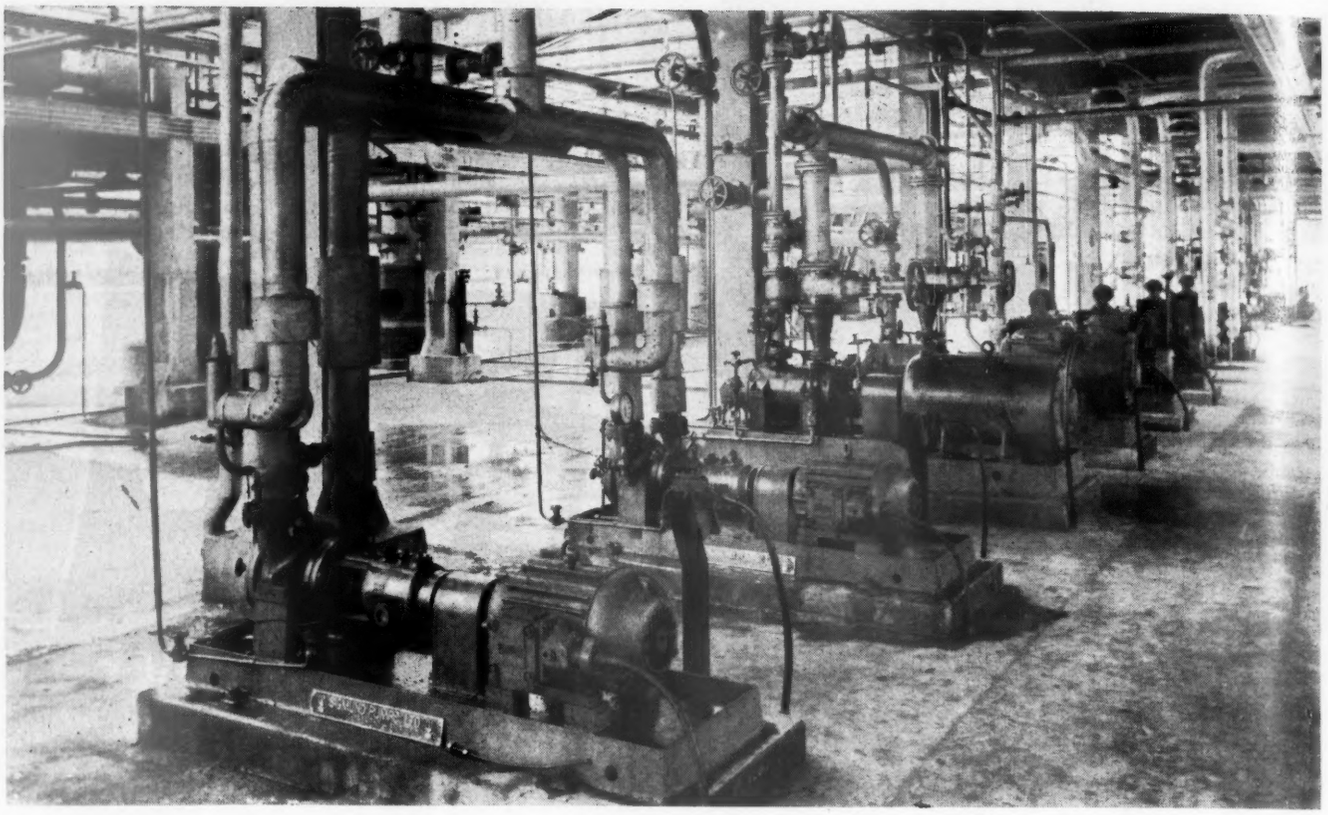


FIG. 4. Pumping station, vertical branches.

parts to a minimum by employing the same internal parts in all three groups. There are single-stage, two-stage, and multi-stage barrel pumps all employing the same impellers and wear rings, and between single and two-stage pumps only one bearing assembly is used.

Thus, about half of the total number of pumps supplied use the same wear rings, shaft sleeves, and other wearing parts in single, two-stage, and multi-stage units, and even in some vertical sump pumps. There are only two sizes of impellers used in these pumps, differing only in width, thus leaving all other components similar. A second batch of about 80 pumps again uses another size of impeller and relevant components, one bearing assembly only being used for this group.

Over three quarters of all the pumps have only two sizes of bearing assemblies in single and two-stage pumps. It will be apreciated that the inevitable problems of maintenance during operation are much facilitated by this method and the work of storekeeping reduced to a few items only, which not only simplifies maintenance but also reduces the outlay for spare parts considerably.

As for the basic design, most of the pumps employ diffusers in either a ring casing or a volute casing. This has, in the case of ring casings, simplified the positioning of pump branches, the intakes being either horizontal, left or right, with outlets opposite, or top-top in an otherwise similar casing and similar direction of rotation. Apart from this consideration, however, diffusers were chosen for another important reason. As is well known, simple volute type pumps have a heavy radial thrust, set up by pressure conditions in the volute against the shaft. This tends not only to deflect the shaft in one direction, but also to create various states of deflection and vibration when controlling pump outputs during operation, which is done automatically by appropriate instrumentation.

The result of this unsteadiness of the shafts is quick wear of packings and shaft sleeves and difficulty in controlling leakage. Diffusers eliminate

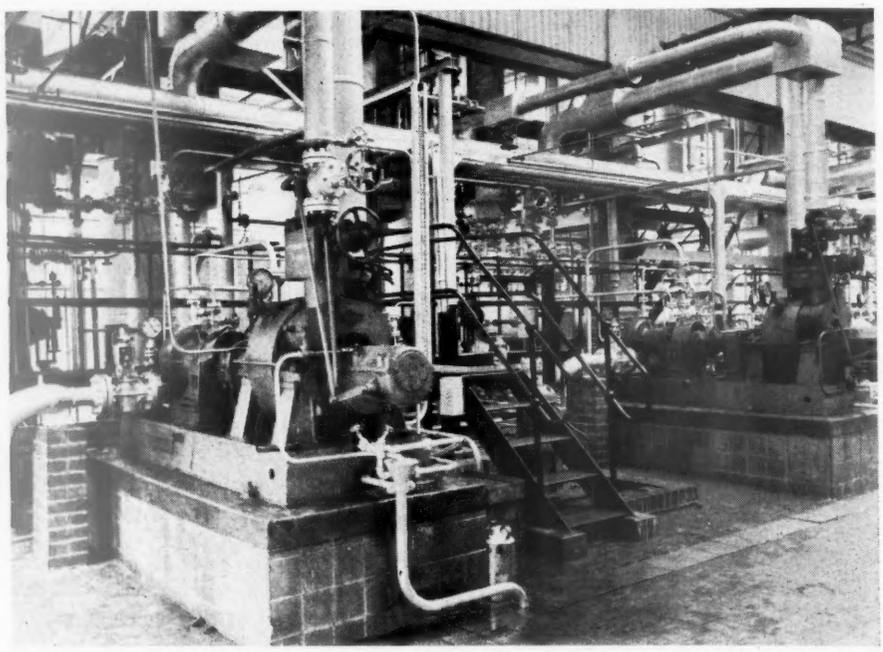


FIG. 5. Reactor pumps handling mixture of hydrocarbon and acid.

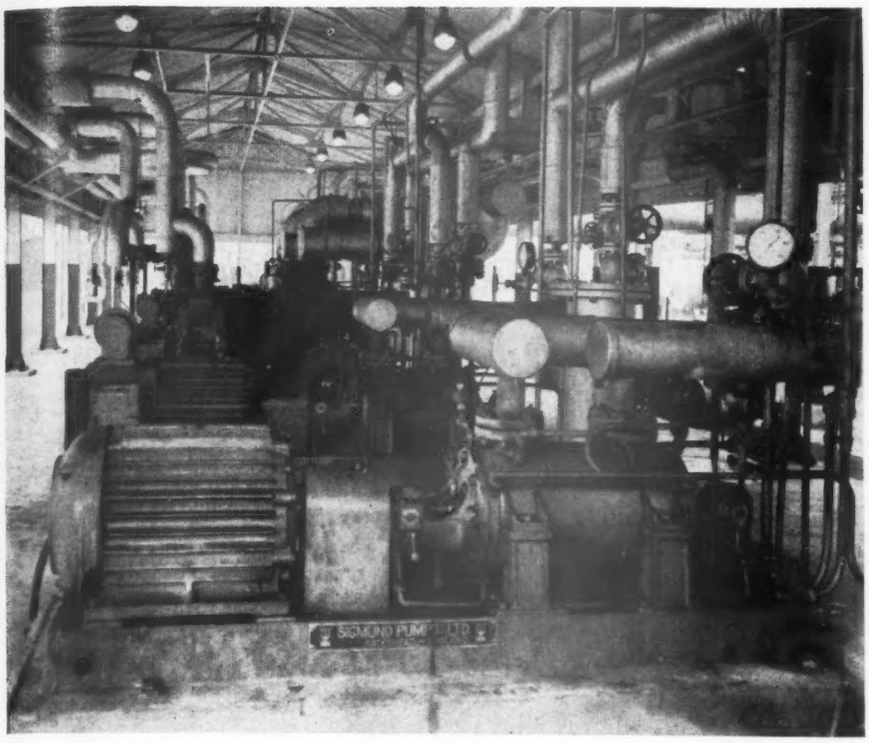


FIG. 6. Group of high pressure barrel pumps.

largely any radial thrust against the shaft and thus tend to reduce leakage to an unavoidable minimum. A leakage of 1 gph, when the price of the liquid is $2 per gallon, would constitute a loss of $48 per day, a loss that is in almost all cases total, because most of the liquids evaporate on getting into the atmosphere. Provision is made for inserting mechanical seals without any further modification, and after first using soft packing with appropriate and, in some cases, rather elaborate sealing systems, mechanical seals are now being installed for the more onerous duties.

As a further means of reducing gland leakage, all stuffing boxes are kept under suction pressure only, this being accomplished by having the pump intake at the stuffing box end. This design feature has the further advantage of washing solids, such as crystals or grit, away from the stuffing box, instead of against it, as is the case with the more orthodox pump design. A cooling chamber surrounding the suction improves suction flow conditions on volatile and/or hot liquids. The general type of pump supplied is shown in Fig. 3.

Finally, it may be of interest to give details of a reactor pump dealing with an onerous sludge consisting of light hydrocarbon and acid. This pump is shown in section in Fig. 4 and Fig. 5 shows reactor pumps handling a mixture of hydrocarbon and acid. Again, the suction inlet at the stuffing box end is a typical feature. In this case, a special sealing system was thought necessary, with injection and throttle clearances, to keep the amount of sealing liquid used to a minimum. The liquid used for sealing is concentrated sulphuric acid, and stuffing box parts, as well as bedplates, are lead lined. Due to the length of the overhung shaft portion thus required, it was found necessary to incorporate an internal bearing. This could be done in this instance because the acid pumped, though extremely corrosive, is a good lubricant. Special materials are used throughout for this pump and the shaft protecting sleeves and bearing bushes are faced with Colmonoy No. 6, an extremely hard and corrosion-resisting material.

For a considerable number of duties, where light hydrocarbons are pumped at high temperatures and pressures, barrel pumps were supplied with from 3 to 8 stages. In these, only 2 joints are used, one of which is under high pressure, so that the danger of leakages from a multitude of vertical casing joints is reduced to a minimum. Fig. 6 shows a group of high pressure barrel pumps. * * *

FIG. 7. Cyclone separator and bag filter.

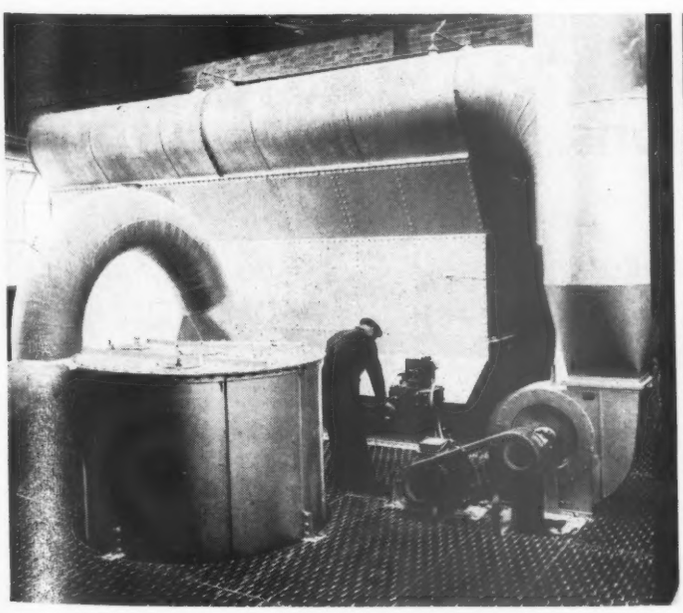
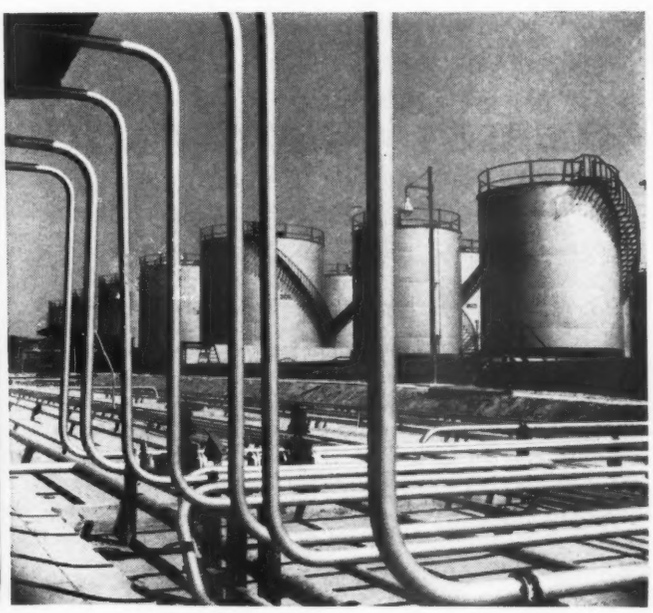
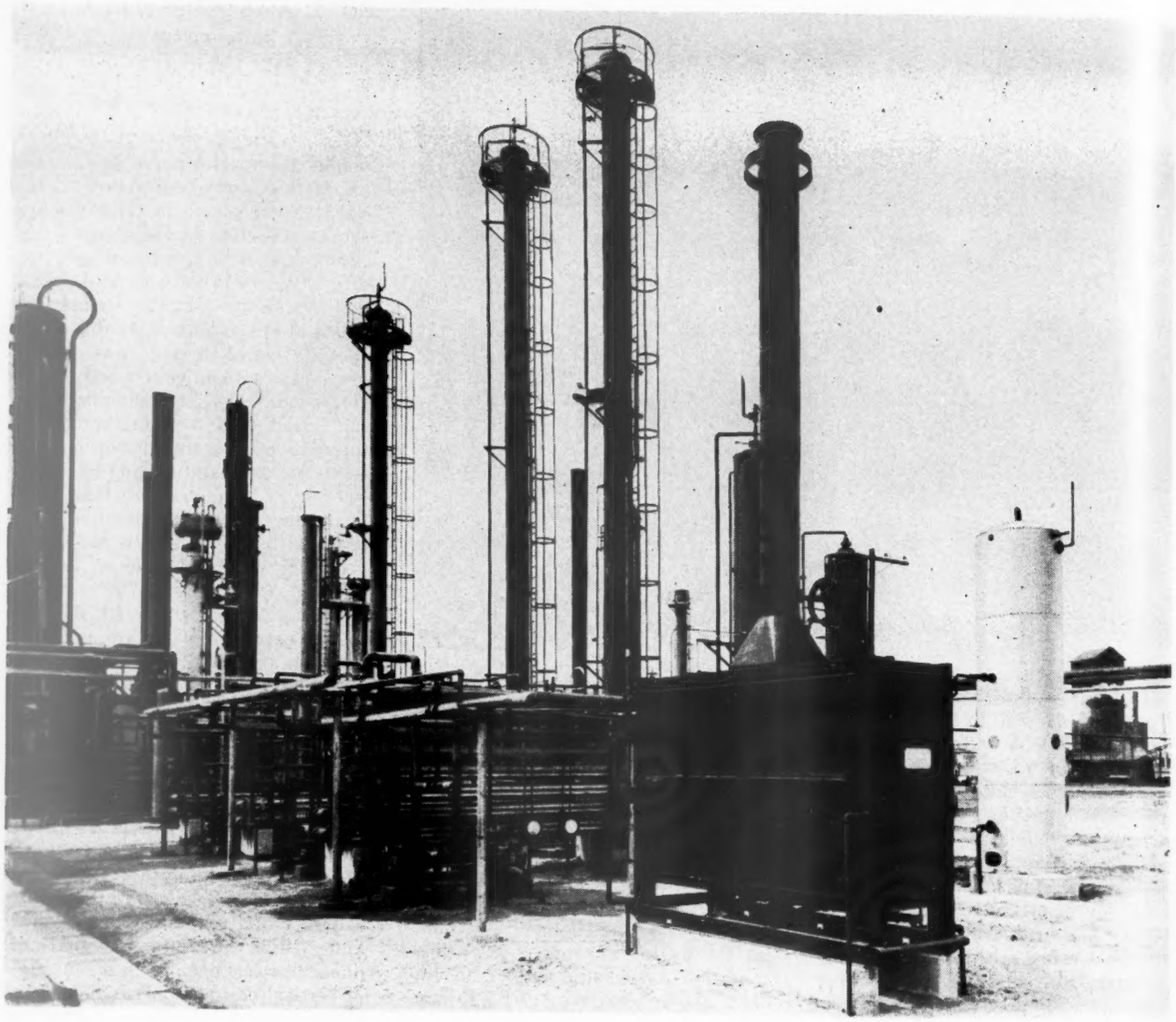


FIG. 8. Pipe lines carry products to storage.





LPG unit at Bareco Oil Company plant, Wichita, Kansas.

Kansas Plant Additions Improve Output

V. R. OAKLEY*

Confronted with the economic problem of improving octane quality of motor fuels, Bareco officials installed a Perco reforming and desulphurization unit, and an LPG unit. A 95 per cent yield of reformed, desulphurized gasoline was produced in 95 per cent yield. Octane rating with 3 ml of TEL was raised from 71 in the straightrun product, to 77.7 Research when reforming at 930 F, and up to 82.5 when running at 960 F. At the last octane rating the yield was 88.2 per cent of the charge. When kerosine production exceeded sales, the entire fraction of kerosine was "cut out" of production, and a kerosine portion was included in the reforming unit charge, with the result that no kerosine is made, and no difficulties are encountered in making that much more gasoline.

*Vice President, Bareco Oil Company.

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search for military fuels are being put to peacetime use by major companies. The small or "minor" companies, because of their lack of such war-born refining facilities, are seeing motor fuel quality rise to a level above their economic grasp. A few small companies have foreseen this very predicament, and it is interesting to observe the means by which they have contrived to stay in competitive operation. In Wichita, Kansas, the Bareco Oil Company refinery was faced with this problem: To augment its plant with facilities sufficiently modern to meet the gasoline quality demanded by new specifications and sufficiently flexible to take care of the seasonal fluctuations in product sales.

Bareco's refinery consisted of a 7500 bbl per day crude oil pipe still, a Dubbs type thermal cracking still, and a UOP catalytic polymerization unit. Charge stock to the refinery is a typical 38-39 deg API Kansas crude. Desalted crude was charged to the heater and separated in the still tower into an overhead stream of straight run gasoline, side cuts of kerosine and heating distillates, and a bottoms product of 24-26 deg API topped crude. Topped crude supplied the feed stock for the Dubbs still, containing a conventional two coil heater, reaction chamber, flash tower, fractionator, and stabilizer. The flash tower yielded a residual product of 8-9 deg API fuel oil, while the overhead flash stream was fed to the fractionator. The fractionating tower received the Dubbs topped crude charge and provided the light and heavy oil feed streams for the furnace coils. The fractionator overhead stream of 400 deg EP unstabilized cracked gasoline passed to an accumulator and accumulator liquid was fed to the stabilizer to yield stabilized cracked gasoline. The fractionator accumulator vapors were scrubbed of gasoline content by topped crude in the PD absorber tower and this enriched topped crude was injected into the fractionator feed. Gases from both absorber and stabilizer towers were processed through the Girbotol unit for removal of H_2S, then compressed and fed to the poly unit. Catalytic polymerization unit effluent, in a second stabilizer, was separated into poly gasoline and gas. This residue gas was utilized in the plant fuel system, which earlier depended chiefly upon city gas for its supply.

Treating procedure for the plant gasoline employed, in addition to caustic washing, the Perco copper chloride process. Liquid copper chloride treating was used for cracked gasoline and solid copper treaters sweetened the straight run gasoline.

Previously, the plant had no system other than the poly unit for gas recovery. All gas production, except for the olefins recovered in poly gasoline, was used as fuel gas. The 48 octane number straight run gasoline could not be further improved, and recent rises in gasoline specifications made it increasingly difficult to dispose of this product, even by blending with natural and cracked gasolines. The straight run gasoline rating with 3 ml TEL per gallon was 71, and tetraethyl lead costs increased with rising octane number requirements.

Bareco decided upon two installations to bring them a more closely integrated and profitable operation. Their major problem of selling the straight run gasoline was solved by building a Perco catalytic desulphurization-reforming unit.

For a brief time after its installation, the Perco unit was used to desulphurize the total refinery gasoline production. A summary of this operation, as given in Table 1, shows that the total gasoline (including straight run, cracked and poly gasolines) was improved by 4 octane numbers at the 3 ml TEL per gal level. With a 750 F top catalyst bed temperature, the desulphurized total gasoline had a Research octane rating at 3 ml TEL per gal of 82.0. A need for further increase in octane number brought about Bareco's decision to reform the straight run gasoline.

The Perco unit is currently being used to upgrade straight run gasoline from 71 to 78 Research octane rating at 3 ml TEL per gal. As shown in Table 2, this improved product of full range 400 EP gasoline is obtained in a 94.4 per cent yield. In addition to the reformed gasoline, the light gases, rich in olefinic content, produced by Perco reforming, are fed to the poly unit and converted to poly gasoline.

TABLE 1. Perco catalytic desulphurization of total refinery gasoline.

Charge stock composition, per cent	
Straight run gasoline	55.2
Cracked gasoline	40.5
Poly gasoline	4.3
	100.0

Operating conditions	
Flow rate, bbl per ton cat. per day	230
Top catalyst temperature, F	750
Chamber pressure, psig	60
Process period, length, days	5

	Charge	Caustic washed product
Yield summary, per cent of chg.		
Gas (C_3 and lighter)	.....	0.7
Desulphurized gasoline	.....	98.2
Bottoms	.....	1.1
Inspection data:		
ASTM distillation, °F		
IBP	96	98
10 per cent	148	148
50 per cent	246	244
90 per cent	340	345
E.P.	392	392
API gravity	61.5	62.5
RVP, psig	8.2	8.8
Total sulphur, weight per cent	0.072	0.027
Doctor test	Sour	Sweet
Octane number, motor method	58.5	62.0
1 ML TEL per GAL	67.8	72.0
3 ML TEL per GAL	74.6	78.5
Research octane number	60.8	63.0
1 ML TEL per GAL	70.8	74.0
3 ML TEL per GAL	78.3	82.0

TABLE 2. Perco catalytic reforming of straight run gasoline.

	Charge	Catalytic reforming product			
Operating conditions:					
Flow rate, bbl per ton catalyst per day	.....	115	115	115	115
Top catalyst temperature, F	.....	930	940	950	960
Chamber outlet pressure, psig	.....	70	70	70	70
Process period length, days	.....	3.5	3	2.5	2
Yield summary, per cent of charge:					
Fixed gas (C_2 and Ltr.), weight per cent	.....	1.5	1.7	2.5	*2.9
C_3 and C_4 Olefin, volume, per cent	.....	0.7	1.7	1.7	*2.1
Propane and Butane, volume, per cent	.....	2.5	3.3	4.6	*6.1
Reformed gasoline, volume, per cent	.....	94.4	93.9	90.5	88.2
400+ Polymers, volume, per cent	.....	Negl.	Negl.	Negl.	Negl.
Carbon, weight, per cent	.....	0.13	0.17	0.21	0.29
Inspection data:					
Total sulphur, weight, per cent	0.020	0.006	0.005	0.003	0.005
Gravity, °API at 60°F	64.5	64.5	64.1	63.8	64.0
RVP, psig at 100 F	9.0	7.8	7.9	8.1	8.0
Distillation, F.					
IBP	92	90	91	93	87
10 per cent	142	142	136	137	135
50 per cent	245	236	235	236	230
90 per cent	328	322	329	335	322
EP	387	388	382	392	396
Recovery, per cent	98	98	98	98	98
Octane number, motor method					
Clear	49.0	54.1	53.7	55.6	58.9
+1 ML TEL per gal	62.6	68.4	70.0	69.9	72.8
+3 ML TEL per gal	73.3	77.4	78.4	79.0	80.4
Research octane number					
Clear	47.9	53.5	53.6	57.4	61.4
+1 ML TEL per gal	58.9	65.3	67.0	68.9	72.1
+3 ML TEL per gal	71.2	77.7	79.4	80.0	82.5

*Estimated.

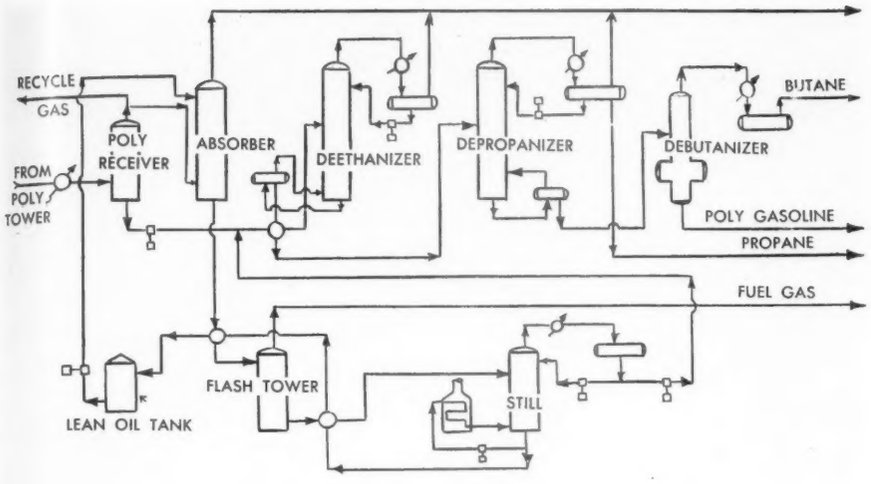


FIG. 1. Flow diagram of LPG unit.

This poly gasoline recovery increases the yield of gasoline attributable to the Perco unit to 95 vol per cent of the straight run charge. After the olefins in the reforming gas have been converted to polymer gasoline, propane, and butane are recoverable in the new LPG unit for direct LPG sales.

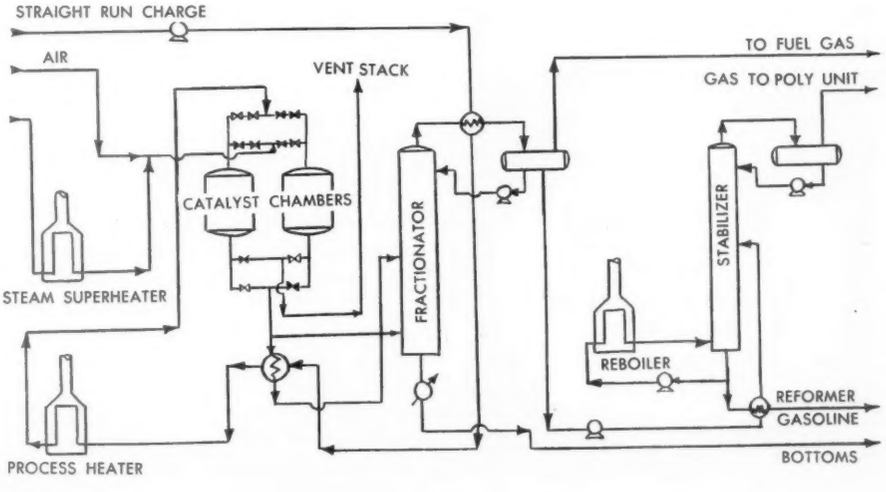
This second new installation, the LPG unit, is planned to produce propane and butane in accordance with the fluctuation in their seasonal demand. Shown in Fig. 1, it was designed and constructed by Born Engineering Company of Tulsa. The LPG unit feed stock consists of Perco fractionator accumulator gas and poly unit effluent. The poly unit, rated at 225 bbl per day, receives Dubbs still gases and stabilizer accumulator gas from the reforming unit. Poly product receiver overhead at 450 psig is stripped of LPG content in an absorber before going to the fuel gas system. Enriched absorber oil is yielded to a flash tower where, at 100 psig, some gas is released to the fuel gas system. The absorber oil is then separated in a 75 psig tower into lean oil (recycled to the absorber) and gases, which combine with the poly receiver bottoms as feed to the deethanizer. Process flow is from deethanizer to depropanizer to debutanizer, with propane and butane being yielded to storage from their respective towers. Butane-free poly gasoline goes to storage as the debutanizer bottoms product. Butane, of course, may be used in three ways, as blending agent for gasoline vapor pressure, as fuel gas, or as a plant product for LPG sales.

Process flow for the Perco unit is shown in Fig. 2. The straight run charge is preheated by exchange with the fractionator overhead and then with the catalyst chamber effluent before entering the process heater to be vaporized. Vapors from the process heater are passed over the bauxite catalyst bed in one of two chambers. Effluent stream from the chamber is utilized to preheat the unit charge before feeding into the fractionating tower, where a very small percentage of heavy ends is removed from the reformate to produce a 400 deg EP gasoline. This 400 deg EP gasoline passing overhead from the fractionator into a reflux accumulator is fed to the stabilizer for removal of sufficient light ends to yield a 7-8 lb RVP reformed gasoline. Vapors from the fractionator accumulator are sent to the fuel gas system, while the richer gas from the stabilizer accumulator is processed through the polymerization unit.

The Perco unit is extremely flexible for refining operations, and can be used either as a desulphurizer of straight run and cracked stocks or to reform a straight run naphtha, yielding the desired octane number product merely by variation of the operating temperature. A relatively mild degree of reforming has been found adequate for upgrading Bareco's gasoline to the desired quality. The reforming operation produces some carbon that is deposited on the catalyst bed, necessitating periodic regeneration of the catalyst. Regeneration is accomplished by changing process flow from one to the other catalyst chamber, and then burning the carbon deposits with a steam-air mixture, the ratio of steam to air being regulated to maintain the catalyst during regeneration at a safely low burning temperature. The Bareco steam plant has a capacity of 42,500 lb per hour of 110 psig steam. This plant steam is superheated in a Perco unit furnace to such temperature as necessary to provide a steam-air mixture at 750 F. Air, compressed in a 125 hp Fuller rotary compressor rated at 844 CFM, is admitted at 40 psig to the superheated steam. Regeneration flue gas from the chambers is quenched with steam and released to the atmosphere through a vent stack. This simple burning procedure regenerates full catalyst activity, permitting throughputs of 80-120 bbl of gasoline per pound of catalyst.

The Perco reforming unit is being operated to charge all of the straight run gasoline produced by the crude still. This unit, licensed by Perco Division of Phillips Petroleum Company, was designed and constructed for Bareco by the Koch Engineering Company, Wichita, Kansas, with a design capacity of 4000 bbl per day. At the current charge rate of 2400 bbl per day, a top catalyst bed temperature of 930 F and a chamber pressure of 70 psig are required to yield 94.4 vol per cent of the charge as catalytically re-

FIG. 2. Perco catalytic reforming unit.



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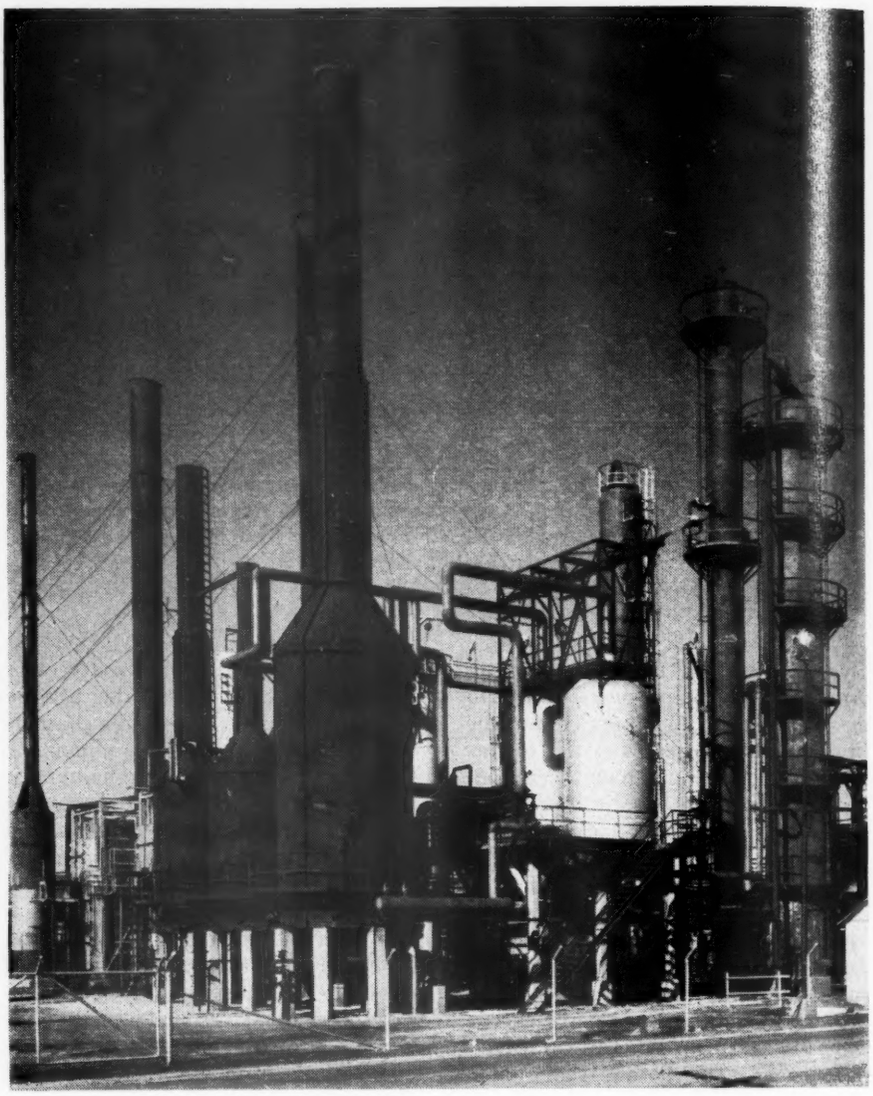

Perco catalytic reforming unit, Bareco plant.

formed gasoline. As shown in Table 2, the 7.8 lb RVP reformed gasoline has a Research octane rating of 77.7 with 3 ml TEL, representing an increase of 6.5 octane numbers over the charge. This quality was desired for the product because of current specifications for motor fuel ratings by the market in which Bareco sells its finished gasoline. A further credit to the Perco unit is obtained from the poly gasoline recovered by conversion of the olefins contained in the gas produced by reforming. This poly gasoline amounts to 0.5 vol per cent of the straight run charge, and brings the overall gasoline recovery to 94.9 vol per cent. Processing of the poly unit effluent gas through the LPG unit recovers C_3 and C_4 content amounting to 2.0 vol per cent of the Perco charge. Total Perco gas production is 200 cu ft per bbl of charge gasoline, however, the residue gas finally going to the fuel gas system amounts to about 175 cu ft per bbl. Carbon deposited on the catalyst during the reforming operation has been about 0.13 wt per cent of the charge stock. This would permit an optimum process period (based on carbon deposition amounting to 15 wt per cent of the catalyst) of approximately one week before catalyst regeneration was necessary. A shorter process period, however, has permit-

TABLE 3.
Bareco Refinery average production.

	Previous	Present
Plant yield, per cent of crude charge		
Fuel gas	4.4	4.2
LPG	.....	1.5
Straight run gasoline	31.8	.....
Reformed gasoline	.....	30.1
Cracked gasoline	23.3	23.3
Poly gasoline	2.5	2.9
Distillates	15.0	15.0
Fuel oil	23.0	23.0
Total	100.0	100.0

Gasoline	Straight run	Reformed	Cracked
Research octane number			
Clear	47.9	53.5	78.0
+1 ML TEL per gal.	58.9	65.3	83.2
+3 ML TEL per gal.	71.2	77.7	87.5

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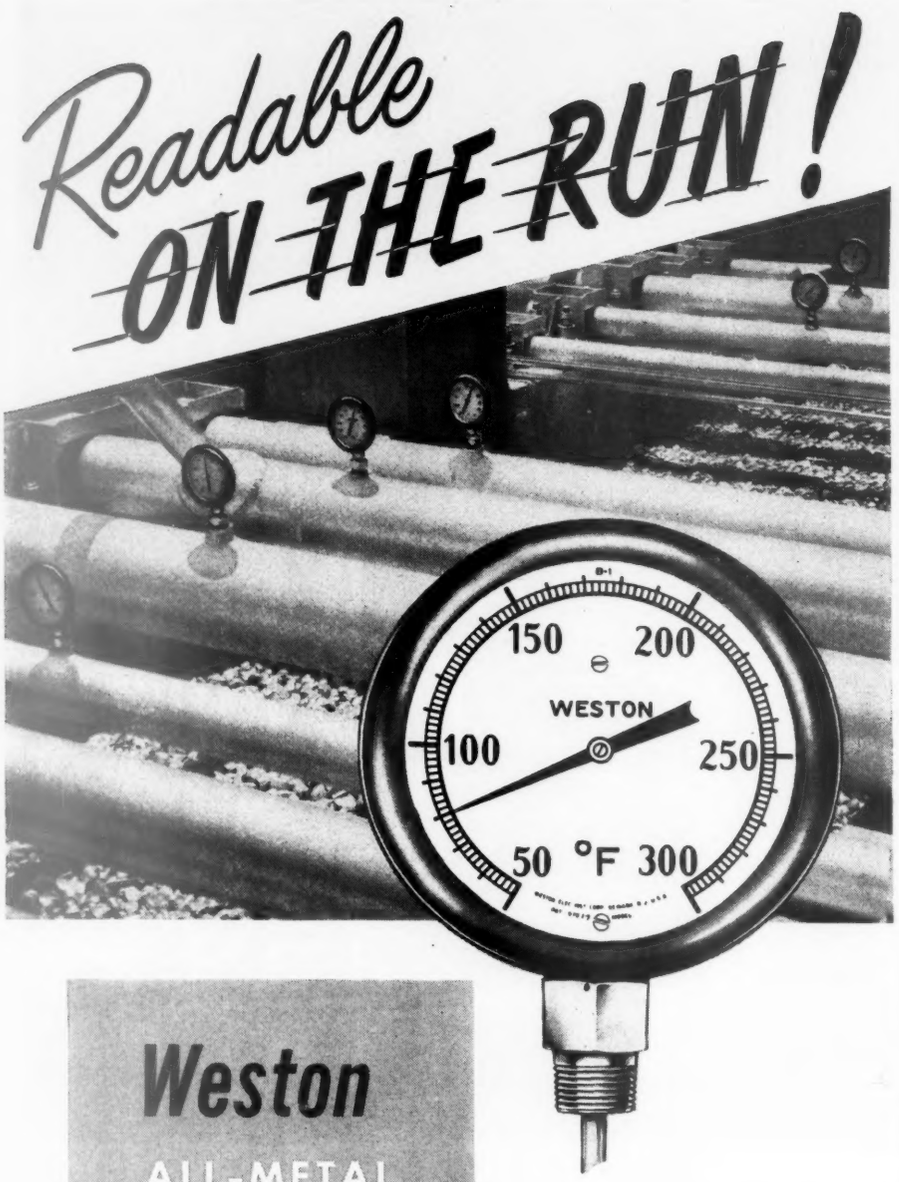

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ted Bareco to produce a constantly sweet, H_2S-free, reformed gasoline without caustic washing. Therefore, the chambers are switched whenever the Perco unit ceases to yield a doctor sweet product. This manner of operation, eliminating the caustic washing step, has resulted in a 3.5 day process period.

Table 2 also shows the results obtained for operations at four different catalyst temperature levels, viz., 930, 940, 950, and 960 F. All operations were designed to produce an 8 lb RVP stabilized gasoline from the 9 lb RVP charge. It will be noted that raising the catalyst temperature from 930 to 960 deg increases the Research octane number of the reformed gasoline from 77.7 to 82.5 (at 3 ml TEL per gal). The 88.2 per cent yield of this 82.5 octane doctor sweet product is accompanied by an increased gas production and carbon deposition, permitting a 2 day process period before switching chambers. Bareco is enabled by this 960 F reforming level to produce from its straight run gasoline a regular gasoline meeting all specifications. They have not yet found it necessary to reform above 930 F, however, in order to meet their gasoline sales requirements.

The highly improved marketing position attained by Bareco through its Perco and LPG installations is seen in Table 3. Its 56.3 per cent gasoline production is only 1.3 per cent lower than the former operation, and its octane value is vastly improved by inclusion of reforming and increased poly gasoline production. Where previously all gas was burned at the plant, 1.5 per cent of the crude can now be marketed as LPG. Bareco is now capable of producing motor fuel of any specification desired for a number of years. In addition to the further improvement of straight run gasoline made possible by increased severity of reforming, appreciable octane improvement is available through desulphurization of the cracked gasoline at the Perco unit.

Just as this article was being finished, Bareco's facilities for kerosine storage were brimful, and kerosine production exceeded sales volume. Bareco met this emergency quite simply by utilizing the flexibility of the Perco unit. They have increased their straight run gasoline end point to include a kerosine fraction as charge to the Perco reformer. Still producing a 400 deg EP reformed gasoline with no change required in reforming conditions, Bareco has entirely eliminated its kerosine production. A large fraction of kerosine is thus being converted to gasoline, and no difficulty has been encountered in this latest operation. * * *

Air view of Stanlow refinery and Manchester Ship Canal, England.

Shell Group Foreign Refining Capacity

FOREIGN refineries of Shell and affiliated organizations averaged nearly three-quarters of a million barrels per day throughput during 1948, according to statistics released recently by Asiatic Petroleum Company. Size of these 30 plants ranges from the 1800-bbl per day distillation-lube-asphalt unit at Ghent, Belgium, and the distilling (topping) unit of the same size at Monheim, Germany, to the 200,000-bbl per day complete refinery at Curacao, Netherlands, West Indies.

Several plants are either behind the Iron Curtain, or are in the hands of rebels, and therefore no data are available regarding their present throughput capacity or their actual operations. These plants include the Deutsche Shell Akt. Gesellschaft at Reisholz, Germany, as well as the German plants at Wilhelmsburg, Grasbrook, and Harburg, the last of which is being repaired, presumably to replace facilities damaged or destroyed by Allied bombing or by Germans in a "Scorched Earth" policy. The Dutch Shell plant at Tjepoe, Indonesia was badly damaged by rebels and its repair and replacement was under consideration at the time the Asiatic report was made.

Comparison of these data with those reported for the first half of 1948 show one more refinery reported, while Romania and Yugoslavia plants are not mentioned in this report.

The entire list of plants have a rated (reported) daily crude capacity of 647,900 bbl per day. A large part of this is topping capacity or the equivalent, only 152,400 bbl per day of cracking capacity, all in eight Dubbs thermal cracking units, is reported. These results indicate that fuels, a major portion of which is for purposes other than motor or aviation fuels, lubricants, waxes, and asphaltic products are the major requirements of the customers of these plants. Again, the refinery at Curacao is the largest, reporting 100,000 bbl per day thermal cracking capacity. This refinery also reports processing an average of 275,000 bbl per day of crude.

Plant rated capacities have increased only 22,400 bbl per day total; the Ardrossan, Scotland plant is reported to have dropped capacity from 43,000 to 3500 bbl per day. The Pernis (Rotterdam), Holland refinery is credited with crude capacity increase from 7000 to 32,000 bbl per day, showing the result of modernization and of replacement of war damaged facilities. The Italian Spezia plant is upped from 7500 to 9000 bbl per day capacity, and several others reported slight capacity increases.

Most significant is the increase in crude processed per day. The average rose from 664,900 bbl per day as of June, 1948, to 728,900 bbl per day as of December, 1948. These figures show the rate and degree of restoration of refining capacity destroyed or damaged by war. Some of this increased crude throughput may also be traceable to increase in available crude due to rise in Middle East production, as well as to restoration of war-damaged wells back in production, especially in the Dutch East Indies (Indonesia). None of the plants or capacity reported include the new and projected refineries reported recently to be planned or under construction. These plants include France, Italy, and possibly other units that will be completed within a year or more.

SHELL AND AFFILIATED COMPANIES—1948

Company name	Country—address	Type * of refineries	Crude oil capacity b/d 1948	Cracking capacity b/d 1948	Type of cracking units	Current crude intake b/d	Remarks
Diadema Argentina, S.A. de Petroleo	Argentina, 788 Avenida Roque, Saenz Pena, Buenos Aires	D/Cr	13,500 [1]12,000	8,000 [1]9,000	Dubbs	12,300 [1]11,000	
Shell Company of Australia, Ltd.	Australia, Clyde Shell Comer, 163, William St. Melborne, C. I., Victoria	D/A	6,500 [1]6,000			6,200 [1]5,000	
Akt. Gesellschaft der Shell Floridsdorfer Mineralol-Fabrik	Austria, Floridsdorf Schubertring 14, Vienna 1.	D/Lub/A/Wax	2,000 [1]2,500			1,600 [1]1,600	
Belgian Shell Company, S.A.	Belgium, Ghent 47, Cantersteen, Brussels	D/Lub/A	1,800[2] [1]2,300[2]			1,700[2]	
Anglo-Egyptian Oilfields, Ltd.	Egypt, Suez, St. Helen's Court, Great St. Helen's, London E.C., 3, England	D/Cr/A	36,000 [1]36,000	6,400 [1]7,000	Dubbs	35,000 [1]35,000	
Cie de Raffinage Shell-Berre	France, Petit Couronne, 29 Rue de Berri, Paris, VIII	D/Ref/Cr	34,000 [1]34,000	4,500 [1]4,500	Dubbs	32,000 [1]32,000	
Cie de Raffinage Shell-Berre	France, Pauillac, 29 Rue de Berri, Paris VIII	D/A/Lub	4,500 [1]4,500			4,500 [1]4,500	
Cie de Raffinage Shell-Berre	France, Berre, 29 Rue de Berri, Paris VIII	D/Lub/Wax	23,500 [1]22,000			23,500 [1]22,000	
Deutsche Shell Akt. Gesellschaft	Germany, Reisholz Shell Haus, Alster Ufer, 4-5 (24a) Hamburg 36.	D					S.B.P. Spirits.
Deutsche Shell Akt. Gesellschaft	Germany, Wilhelmsburg Shell Haus, Alster Ufer 4-5 (24a) Hamburg 36	D					S.B.P. Spirits.
Deutsche Shell Akt. Gesellschaft	Germany, Monheim Shell Haus, Alster Ufer, 4-5 (24a) Hamburg, 36	D	1,800 [1]1,700			1,800 [1]1,000	
Deutsche Shell Akt. Gesellschaft	Germany, Grasbrook Shell Haus, Alster Ufer, 4-5 (24a) Hamburg, 36	Lub					
Deutsche Shell Akt. Gesellschaft	Germany, Harburg Shell Haus, Alster Ufer, 4-5 (24a) Hamburg, 36	D/Lub/A					Being repaired.
Shell Koolaj Reszvenytarsasag	Hungary, Budapest Josef Nador Ter 5/6, Budapest	D/A/Lub/Wax	4,000			1,500 [1]1,500	
N.V. de Bataafsche Pet. Mij.	Indonesia, Tjepoe Carel van Bylandtlaan, 30, The Hague	(Inaccessible)					Damaged in political disturbances. Rebuilding under consideration
N. V. de Bataafsche Pet. Mij.	Indonesia, Wonokromo Carel van Bylandtlaan 30, The Hague	D/A	2,000 [1]1,500			2,000 [1]1,500	
N.V. de Bataafsche Pet. Mij.	Indonesia, Balikpapan Carel van Bylandtlaan 30, The Hague	D	8,500 [1]8,500			8,500 [1]8,500	
N. V. de Bataafsche Pet. Mij.	Indonesia, Pladjoe, Carel van Bylandtlaan 30, The Hague	D/Ref/Cr	70,000 [1]45,000	10,000 [1]7,700	Dubbs Dubbs	64,000 [1]50,000	
N. V. de Bataafsche Pet. Miji.	Indonesia P. Brandan, Carel van Bylandtlaan 30, The Hague	(Inaccessible)					
Soc. per l'Industria Italiana del Petrolio	Italy, Spezia, Piazza della Vittoria, Genoa	D/Cr/A	9,000[3] [1]7,500	1,500 [1]1,500	Dubbs Dubbs	7,500[3] [1]7,500	
N. V. de Bataafsche Petroleum Mij.	Netherlands, Rotterdam, Carel van Bylandtlaan 30, The Hague	D/Cr/Lub/A	32,000 [1]7,000	19,000 [1]16,500	Dubbs Dubbs	53,000[4] [1]23,000	
N. V. Curacaosche Pet. Industrie Mij.	Netherlands West Indies Curacao-Willemstad	D/Ref/Cr /A/Lub	200,000 [1]200,000	100,000 [1]100,000	Dubbs Dubbs	275,000[4] [1]275,000	Alkylates [1]3,600 B/D.
Arend Petroleum Maatschappij	Netherlands West Indies Aruba, Oranjestad, Aruba	D	27,000 [1]27,000	3,000 [1]3,000	Dubbs Dubbs	42,000[5] [1]35,000	
Sarawak Oilfields, Ltd.	Sarawak, Lutong Miri, Sarawak	D	36,000 [1]35,000			36,000 [1]35,000	
United British Oilfields of Trinidad,Ltd.	Trinidad, Point Fortin St. Helen's Court Great St. Helen's, London E. C. 3, England	D/A	28,000 [1]28,000			28,000 [1]25,000	
"Shell" Refining and Marketing Co., Ltd.	United Kingdom, Shellhaven Norman House, Strand, London W. C. 2, England	Lub/A	16,600[6] [1]16,600[6]			8,100[6] [1]7,300[6]	
"Shell" Refining and Marketing Co., Ltd.	United Kingdom, Stanlow, Norman House, London, W. C. 2, England	Lub/A	16,700[6] [1]16,700[6]			9,200[6] [1]10,000[6]	Detergents 35,000[1] tons.
"Shell" Refining and Marketing Co., Ltd.	United Kingdom, Heysham, Norman House, Strand, London, England	D	30,000 [1]30,000			29,000 [1]29,000	
"Shell" Refining and Marketing Co., Ltd.	United Kingdom, Ardrossan, Scotland	A	3,500[2] [1]43,000[2]			3,500[2] [1]3,500[2]	
Shell Caribbean Petroleum Co.	Venezuela, San Lorenzo, 117 Main Street Flemington, N. J., U. S. A.	D	41,000 [1]41,000			43,000 [1]41,000	
	TOTALS		647,900 [1]627,800	152,400 [1]149,200		728,900 [1]664,900	

Note: Capacities for Romania and Yugoslavia not reported for second half of 1948—Confiscated by Communists.
*D=Distilling; Lub=Luboil; A=Asphalt; Cr=Cracking; Ref=Reforming.
[1]Figures reported for first half of 1948.
[2]Topped crude capacity.
[3]Includes 1000 B/D topped crude.
[4]Includes crude direct to cracking unit.
[5]Cracking unit running as distillation unit.
[6]Topped crude and various distillates.

* * *

Progress Report on Anti-Detonant Injection in Automotive Engines*

C. H. VAN HARTESVELDT†

BASED on experience it is feasible to provide the public with sizable increments of anti-knock quality for use with commercial gasolines. Today's premium fuels can readily be extended to 100 octane number without large refinery and distribution system investments by the petroleum industry. Marketing divisions can earn new income from the sale of Vitane as their return for contributing to more economical motoring.

National distribution of the fluid and use of the system with high compression ratio engines may be accomplished in the following steps:

1. Sales of Vitameters and Vitane nationally as in Columbus, Ohio.
2. Installations on additional cars through reduction of Vitameter price with the resultant mass production in Step 1.
3. Reduction in price of Vitane by bulk sale at outlets where volume justifies it.
4. Adoption of carburetor-mounted Vitameters by car manufacturers for use with high compression ratio engines.
5. Further reduction of Vitane price as justified by the increased volume sold.

Introduction

Anti-knock quality for gasoline in the form of an anti-detonant fluid trade-named Vitane, used with a carburetion device trade-named Vitameter, can bring the oil industry large savings in future refinery investment and will provide income from the sale of the fluid at service stations. The progress made toward these ends and plans for the future are the subjects of this paper.

The Vitameter

Five technical papers have been presented before the Society of Automotive Engineers on the Vitameter and its use.[*1, 2, 3, 4, 5.] The work covered by these papers is too broad for a complete review here, but they should be obtained for a full account of the development of the device and anti-detonant fluid. Briefly, a knocking car detonates only when you "step on the gas." This is the same thing as saying that part throttle octane requirements are lower than full throttle requirements. Testing done and reported by Mr. R. J. Greenshields of the Shell Oil Company explored an engine's octane requirement with relation to speed and throttle opening. The results are shown in Fig. 1. Notice that the full throttle octane requirement varies from 85 to 75, but the level road requirement is only 45 even at 60 miles per hour.

The function of the Vitameter is to inject an alcohol-water base solution (methyl, ethyl, or isopropyl alcohol) containing tetraethyl lead into the intake manifold only when the throttle is wide open or nearly wide open. As a result, alcohol, water, and tetraethyl lead accompany gasoline into the engine cylinders only when detonation would otherwise take place. At part throttle operation no anti-detonant is used. This control is effected by the action of intake manifold pressure on a diaphragm in the device which determines when anti-detonant injection will occur.[*1] Since vehicles operate at full throttle only part of the time, this method of using an anti-knock solution with gasoline is inherently more economical than blending.

The injection of anti-detonant when needed gives an effective increase in the octane number of the gasoline burned. The reason for this increase is the cooling effect of the water in the combustion chamber, the blending effect of the alcohol with the gasoline, and the anti-knock effect of tetraethyl lead. Considerable testing of various compositions was done both in an engine connected to an electric dynamometer and in cars and trucks on the road. The factors considered in selecting an optimum concentration of alcohol were as follows:

1. Largest power increase for a given anti-knock quality effect.
2. Highest anti-knock effect for the alcohol consumed.
3. Highest anti-knock effect per unit volume of solution injected.
4. Least tendency for boiling or vapor lock in the anti-detonant solution system.

From the results gathered the solution tentatively selected as an optimum is 85 per cent alcohol and 15 per cent water containing 3 cc of tetraethyl lead per gallon. Fig. 2 shows a typical passenger car installation of the Vitameter ("Anti-Detonant Injection," Page 3—Fig. 6)[4] and Fig. 3 shows a cross-section of the device ("Anti-Detonant Injection," Page 4—Fig. 7).[4]

Fig. 4 shows the response of five different fuels to various amounts of Vitane injection. However the fact that injection takes place only at or near full throttle makes the over-all consumption considerably less. This over-all consumption depends upon two main factors. These are the ratio of power to gross vehicle weight and the terrain over which the vehicle operates. Low power and hilly terrain contribute to higher over-all consumption. Passenger cars in general have the highest power to weight ratio and Vitane (formerly Vitol) consumption in owner service is shown below:

Vehicles	Type of driving	Percent Injection at full throttle	Research Octane No. reached with St. R. (63.5)	Reg. (80.0)	Prem. (86.7)	Consumption as percent on gasoline
Buick 1948 Roadmaster	City and country	11.5	....	....	95.2	0.9
Cadillac 1948 (High Comp. Hds.)	City and country	20.0	....	....	100+	2.0
Cadillac 1948 (High Comp. Hds.)	8,726 mile Western trip	20.0	....	....	100+	3.5
Oldsmobile 1948, 8 cyl.	City	15.0	....	94.5	97.4	2.2
Oldsmobile 1948, 8 cyl.	Country	15.0	....	94.5	97.4	1.5
Plymouth taxicabs	City taxicab and airport limousine.	9.0	77.5	....	.....	2.1
Cadillac limousine		12.0	82.0	....	.....	
Chrysler limousine		10.5	79.5	....	.....	
Packard limousine		14.0	85.5	....	.....	

*Presented before Natural Gasoline Association of America. Twenty-eighth Annual Convention, Texas Hotel, Fort Worth, Texas.

†Vice President of Thompson-Toledo Vitameter Corporation.

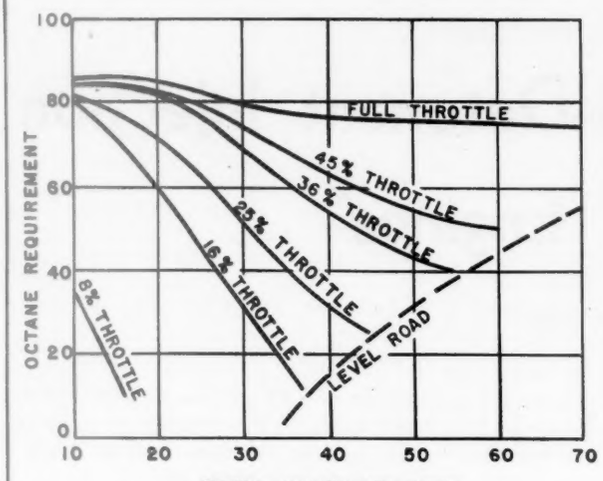

FIG. 1. Octane requirements at various throttle openings for 1939 car.

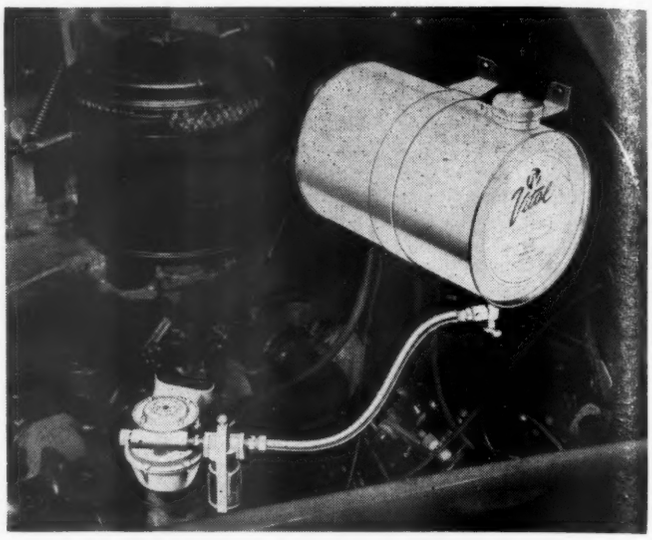

FIG. 2. Vitameter installed on conventional car fuel system.

Service Experience

The above technical summary would not be complete without a review of Vitameter use in service. The total commercial vehicle-miles run with the Vitameter supplying a necessary increment of anti-knock quality are shown below:

Heavy trucks	Over 3,500,000 miles
City buses	Over 500,000 miles
Taxicabs	Over 5,000,000 miles
	Over 9,000,000 miles

After running 23 airport limousines and 65 taxicabs on 63 octane gasoline for one year, the Yellow Cab Company here in Cleveland is installing Vitameters on 140 additional taxicabs.

In addition, more than 2000 Vitameters are in use on passenger cars as a result of sales to the public in Columbus, Ohio. Continuing fluid sales there indicate that substantially all of the Vitameters installed are still operating after six months from initial sales. In none of this Vitameter experience has there been operating or maintenance troubles of any kind. Specifically:

1. Engine wear does not increase, and in fact, actually was lowered in controlled tests.
2. Warm-up time with the Vitameter is the same or less, not more.
3. There is no determinable effect upon motor oil or engine lubrication.
4. No fire or toxicity problems have been found.
5. Starting is not affected.
6. No engine damage has been reported due to detonation resulting from running out of Vitane.
7. No additional trouble or inconvenience to the car owner associated with the requirement for another fluid has been found where Vitane has been available in service stations.

Sales in Columbus, Ohio

Developing a device and a fluid which supply anti-knock quality in a trouble-free manner, is only part of a total effort to bring the benefits of the system to the public and the oil industry. Proper sales and distribution methods are required to achieve the desired result of decreasing costs with increasing sales. Progress has been made in a trial sales effort in Columbus where considerable success was achieved. However, this success cannot be interpreted fully without a grasp of future steps and their feasibility. The sales campaign is described below:

On September 15, 1948, Vitameters were placed on sale to the public in Columbus, Ohio. The Pure Oil Company, the Shell Oil Company, and the Standard Oil Company (Ohio) cooperated by displaying swing board signs, a Vitameter, and banners at their stations. In addition, descriptive folders were available there and Vitane (then named Vitol) was sold in quart cans. Vitameters were installed chiefly at car dealers and repair shops. Newspaper, radio, and billboard advertising was used but the latter two were proved ineffective by subsequent surveys.

The Vitameter sold at retail for $29.90. After installation and first fill of Vitane the total cost to the customer was nearly $35.00. Vitane sold for $1.20 per gal. in quart cans. Based on gasoline the costs to the customer were as follows:

Vitane consumption as per cent of gasoline	Vitane cost per gal. of gasoline
1	1.2 cents
2	2.4 cents
3	3.6 cents

The Vitameters sold were set to give 10 or more research octane numbers on top of regular grade gasoline and 8 above most premium fuels. The average car used Vitane equal to about 2 per cent on gasoline, so the cost of octane numbers represented by purchases of Vitane were competitive with the cost of octane numbers as represented by the difference between regular and premium gasolines. However, octane numbers on top of premium gasoline were available only with the Vitameter.

After five months of the sales effort, 2053 Vitameters were in use and 14,000 gal of Vitane were sold in a market of 90,000 vehicles. The average Vitameter equipped car will use about one gallon of Vitane per month and its sales has continued at a rate which indicates that substantially all of the Vitameters are still in use.

Distribution and Costs

The prices set for Vitameters and Vitane and the number sold indicate

"Don't send a boy to do a man's work"

There's a Powell Valve* that's just *right* for every known FLOW CONTROL SERVICE

Most valve failures are the result of misapplication . . . installing valves that aren't of the right design or sturdy enough to do the job for which they are selected. In other words, it's like "sending a boy to do a man's work."

On the other hand, it's a waste of money to specify costly valves for services where less expensive ones may be used. This amounts to putting a man on a job that a boy can do.

To avoid misapplication: (1) standardize on Powell Valves; (2) consult Powell Engineers as to which valves are specifically adapted to each and everyone of your individual flow control requirements.

Powell makes such a *complete* Line* that there is a Powell Valve *exactly* suited to every existing service, from the simplest to the most specialized or exacting. Ask your nearest Distributor—or write direct.

Fig. 1314-A—Class 1500-pound Steel "Y" Valve. Has integral bonnet and welding ends.

Fig. 1561—Class 150-pound Cast Steel Swing Check Valve with flanged ends and bolted cap.

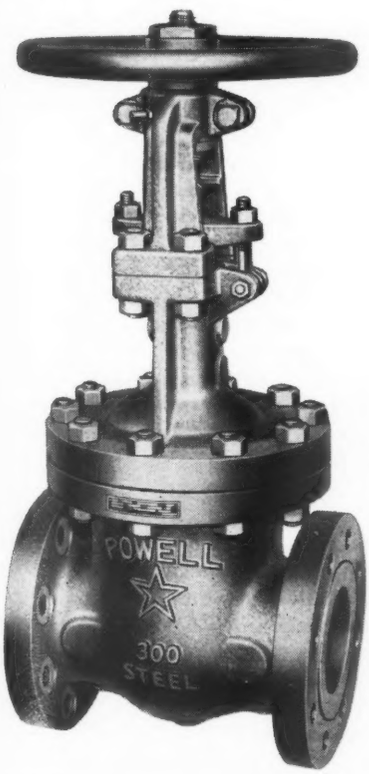

Fig. 3003—Class 300-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke, tapered solid wedge.

Fig. 375 — 200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze disc.

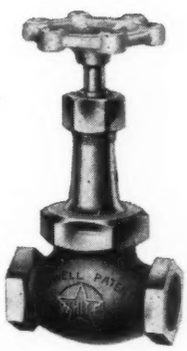

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable wear-resisting "Powellium" nickel-bronze disc.

*** Powell Valves are made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type—Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves—are included in the Complete Powell Line.**

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DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES

that a luxury market was sought and obtained in Columbus. Expanding this market to a place of importance in the national economy could proceed according to the following steps:

1. Sell Vitameters and Vitane nationally at the prices used in Columbus.
2. With the production of Vitameters thus obtained, lower the price substantially and increase the percentage of cars with Vitameters installed.
3. Use increased volume of Vitane to justify bulk sale at a lower price (similar to the bulk sale of some motor oils).
4. Gain automobile car manufacturer adoption with the carburetor-mounted Vitameter unit now developed.
5. With the increased volume thus obtained, reduce Vitane price still further.

The above program is a broad one and the end result is attainable only if each step can be taken successfully. A discussion of these steps is presented below:

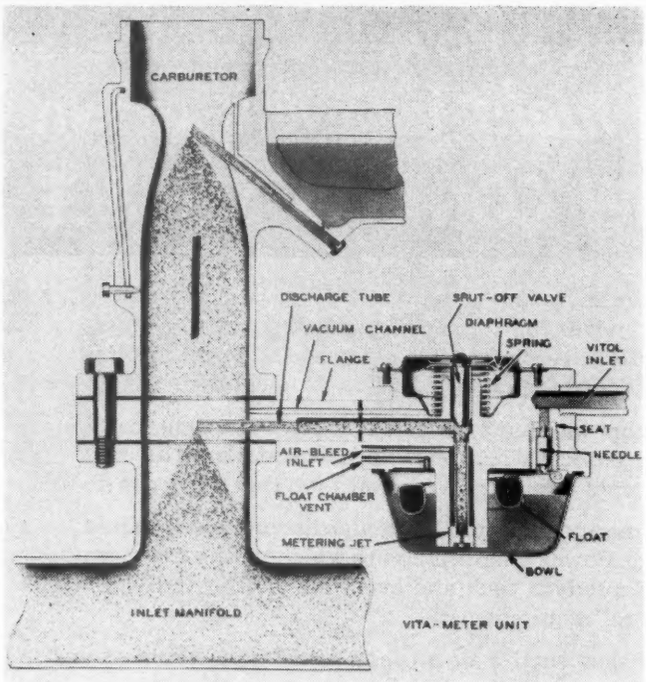
Step 1. Sale of Vitameters and Vitane to the Public

Engineers engaged in fuel testing know the relationship of octane number, spark advance and car performance. Others ask, "What does the customer get when he buys the Vitameter?" and "What does it do for him?" The best considered answer from the customer himself came from a vice president of one of our largest oil companies. He had purchased a 1948 car in the higher price range and reported his experience as follows:

"Spark setting as delivered is not known, and knock-free performance was obtained on Premium Fuel A. However, after about 500 miles, knocking became quite noticeable and then, gradually, quite heavy and objectionable. Backing off the spark somewhat (number of degrees unknown) eliminated the trouble temporarily, but after a total of about 1500 miles knocking again became objectionable. One tankful of Super Premium Fuel B added to 2 or 3 residual gallons of Premium Fuel A reduced this knocking to what I would term "light knock."

A second retarding of the spark permitted return to the use of Premium Fuel A. (Total retardation about 3/8 in. on the distributor base sector where the adjustment is made —number of degrees unknown). No further change in fuel or spark advance was made until Vitameter was installed. The car seemed somewhat "heavy" or sluggish.

FIG. 3. Diagrammatic illustration of design and operating principles of Vitameter.



At 3800 miles, Vitameter and Vitane were installed. Spark was advanced to point of "incipient knock" with warm engine under full throttle on steep hill, which setting was slightly (about 1/8 in. on sector) in *advance* of original factory setting.

Results after 1060 miles of operation with Vitameter are as follows:

Marked improvement in "liveliness" due to advancing spark. Performance is now exceptional.

Virtual freedom from knock under accelerating conditions (there has developed, however, some slight tendency to knock at part throttle with fully warm engine. This is eliminated by opening throttle, reducing manifold pressure, and injecting Vitol).

Vitane consumption: exactly 2 quarts in first 580 miles. Estimated consumption to date, one gallon.

Fuel consumption: 12.3 miles per gallon, principally local, light traffic driving. This represents some improvement over 10.8 miles per gallon obtained in first 1500 miles of operation, but I believe due principally to fact that car is now broken in and that considerable of the original mileage was on snow-covered roads, using tire chains, etc.

I would say that the device is distinctly worthwhile where knocking on available fuels is a problem and where solution of the problem by retarding the spark to a degree adversely affecting performance is undesirable."

Sales of Vitameters in Columbus brought this response from many car owners but the intensive advertising campaign used threw some doubt upon results that could be achieved with a more economical effort. At least a partial answer was provided by two Cleveland car dealers who sell and service a car of comparatively high octane requirement. Without any direction or solicitation from us these dealers obtained Vitameters and Vitane from a friendly dealer in Columbus and each has installed over 100 units. Their Vitane sales are continuing at the rate of 100 gal. per month. Both are enthusiastic about the reception of Vitameters by their customers—and the price was $40.00 installed!

A service division manager of a large car manufacturer viewed the market this way: "As long as we continue to push the octane scale there will be a need for Vitameters or their equivalent for three reasons:

1. Compression ratios will be set high enough to bring the best performance to most car owners. This means that normal production tolerances will give a

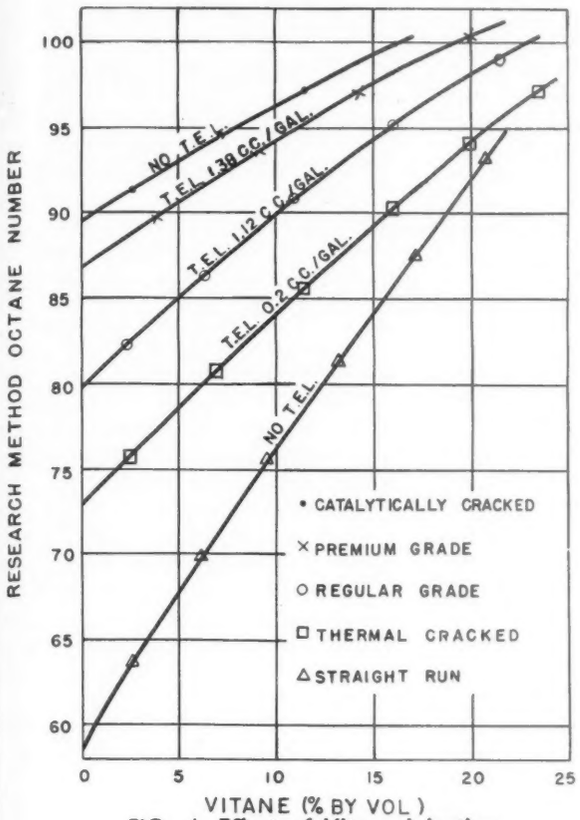


FIG. 4. Effect of Vitane injection on research method octane rating.

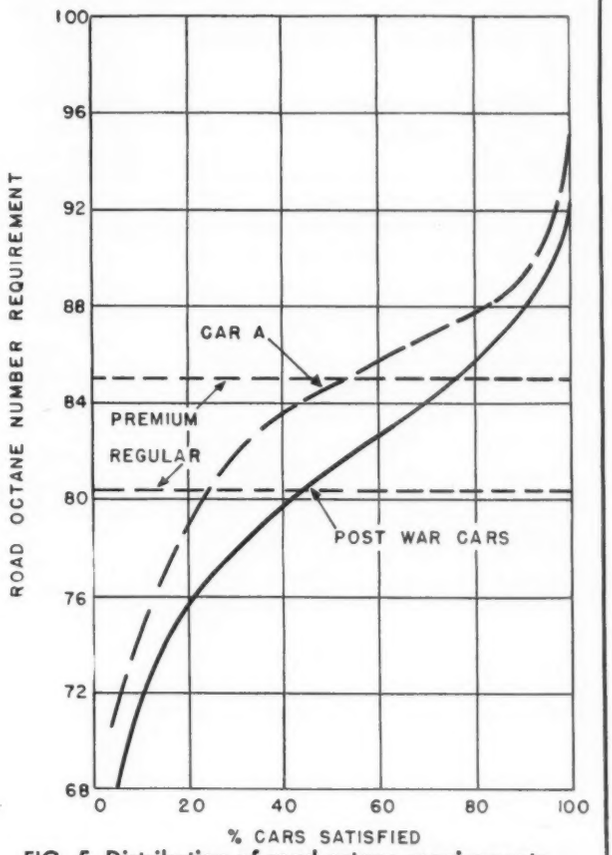


FIG. 5. Distribution of road octane requirements.

percentage of cars that will knock at satisfactory spark settings on the best fuel available.

2. In some areas of the country the octane levels of gasoline supply is considerably below that used for selection of compression ratio.
3. Even in areas where one or two gasolines are high enough in anti-knock quality people still will want to buy other lower octane gasolines for a multiplicity of reasons.

The Vitameter is a positive answer to knock complaints resulting from the above causes and is much to be preferred over the negative answer of retarding spark, supplying thicker gaskets or affording temporary relief by carbon removal."

Fig. 5 shows a typical octane requirement survey of cars in use by the public. Manufacturing tolerances, various amounts of carbon accumulation, and variations in spark settings produce a wide range of octane requirements in every make of car. Because of the many variables there is no commercially practicable octane level that will satisfy all cars on the road. Premium fuels currently have a road octane rating of approximately 85 (88 Research). Raising this octane number to 86 Road (90 Research) reduces the unsatisfied increment from 25 per cent to 19 per cent for all cars and from 50 per cent to 38 per cent for car A. This shows that without a positive answer for knock complaints such as the Vitameter or its equivalent, a given percentage of the motoring public will constantly and hopelessly be shopping for higher octane number gasoline.

Step 2. Lower Vitameter Price

The number of Vitameters necessary for a national sales campaign (600,000 based upon Columbus results) will assuredly bring production and procurement economies which will make it possible to sell the Vitameter for a mass production price. The drop from the present figure of near $30.00 should result in sales to an additional increment of car owners who would like higher knock-free performance but who are unwilling to make the investment required in Columbus.

The reduction in costs will spring from more than the economies that go with producing more units. Whenever engineers with a good knowledge of required functions and engineers expert in production methods work together, changes in design with no impairment in performance result in a cheaper and better product. It is impossible to get this cost reduction method under way without actual commercial production.

Step 3. Lower Selling Price of Vitane

As the percentage of cars with Vitameters installed increases above the 2 per cent mark reached at Columbus, there will be at least some retail sales outlets where bulk sale of the fluid will be justified. A car uses about as much Vitane as it does motor oil but Vitane is not divided up into several price classes and SAE numbers. If there were only one motor oil and only one grade of SAE numbers for all cars, I am sure that bulk sale would be more widespread. For example, fleets of any size invariably dispense their motor oil in bulk.

The cost of putting a fluid in quart cans is 22 cents per gallon. As this cost goes through distributional mark-ups, the customer finally pays about 60 cents for the tin wrapping on

motor oil, anti-freeze, and Vitane. Larger sales volume is the only way to justify elimination of the packaging charge.

Step 4. Car Manufacturer Adoption

With Vitane dispensed in bulk at about 75 cents per gallon, the Vitameter is a doubly attractive source of anti-knock quality above the premium fuel level. Its use by one or more car manufacturers at that time is probable because the customer can be given more miles per dollar in utilizing the additional octane numbers. At 75 cents per gallon Vitane will take present day premium fuel up to 100 octane for 1.5 cents per gallon at retail. The additional manufacturing cost for 100 octane number gasoline if passed through distributional mark-ups will be more than this unless some revolutionary new refining process is developed. And even if it is, Vitane and the Vitameter can be used to add an economical increment of anti-knock quality even to this hypothetical, new gasoline.

Step 5. Further Developments

With national distribution of Vitameters and Vitane and with their use by car manufacturers, the research facilities and sales ingenuity of our two largest industries can ultimately be brought to bear upon the system and additional economies and improvements are sure to result.

Our own progress with limited facilities and manpower has been consistent and encouraging. The field of applying an increment of anti-knock quality only when the engine needs it and only in the amount needed is a green pasture for technical effort and the sales appeal which can be based upon the results rests upon the basic human urge to get there first and fastest. With such raw material anything short of broad ultimate success would be surprising.

Vitane Toxicity and Future Sales

The methanol in Vitane and its content of 3 cc tetraethyl lead per gallon are a new combination of materials of known toxicities. Although methanol has a history of safe use as an anti-freeze and tetraethyl lead presents no hazard in gasoline, a new type of use for these two materials suggests that hygienic information be gathered in the public interest. Consequently the problem was assigned early in 1948 to the Kettering Laboratory of Applied Physiology under the direction of Dr. Robert A. Kehoe.

To date the information obtained has revealed no acute or serious dangers in the use of Vitane. In fact, the problem is whether or not any danger exists at all.

The history of safe public use in Columbus, Ohio along with other considerations brought a decision to market Vitameter to the public in Cincinnati on May 15, 1949. The handling of Vitane will be observed by the Kettering laboratory as in Columbus. With continued, safe use of Vitane it is probable that the marketing area will be expanded next fall.

Significance to Petroleum Industry

The refinery investment and yield reduction associated with raising gasoline octane number has been well reported in the literature. L. L. Davis[7] states that, "Processing for higher octane fuels reduces the volume of base refinery gasoline approximately 1 per cent for each octane number improvement." This loss can be reduced somewhat by installing specialized equipment for producing higher octane number gasoline. A 100,000 bbl per day refinery using 1 ml of tetraethyl lead per gallon requires an additional investment of approximately 57 million dollars to raise the octane number from 85 to 97.[*6] Such an investment on top of that required for providing larger and larger amounts of petroleum products of all kinds would place an almost intolerable and needless investment requirement upon the petroleum industry. For smaller refineries there is no commercially economic way to produce such high octane number gasoline because the relatively low throughput will not allow the equipment to be written off in a reasonable time.

The Waste in Providing High Octane Number Gasoline for a Fuel

As octane number and compression ratios have advanced together over the past 25 years, each new increase found a large segment of the motoring public supplied with gasoline higher in anti-knock quality than could be utilized by the older vehicles operated. This was the price of progress and it was not too great a price because the cracking processes developed to produce more gasoline also gave a relatively cheap increase in octane number. This is no longer true, first because additional advances in anti-knock quality will cost considerably more than those previously made, and secondly because the large number of cars satisfied by today's gasolines is greater in proportion to potential, higher compression-ratio models than in any time in history. For example, 3,491,000 new passenger cars were registered in 1948. Assuming that sufficient agreement in the automotive industry were obtained to produce one-half of this amount with high compression ratio engines such vehicles would still represent only 4½ per cent of the cars on the road. Producing a grade of gasoline just for these cars would bring considerable waste in the form of the use of this gasoline by cars produced in previous years. The Vitameter system allows the supply of better anti-knock quality only to those vehicles which specifically need it.

In the marketing divisions of the oil industry, the sale of anti-knock quality as a separate item (Vitane) will bring a return for making a necessary contribution toward the higher power and greater mileage of high compression ratio engines. At the present time, there appears to be no additional reward to marketers for passing along the higher quality gasoline which will be required for the higher power, longer mileage, high compression ratio engines promised by the car makers. So far, refinery costs for higher octane number gasoline have been absorbed or merely passed along to the customer. Anybody unfamiliar with the workings of our economic system might say this was a break for the consumer. Actually it is a loss in the larger sense because a lack of incentive has meant slower progress. If sufficient incentive had been there, petroleum marketers might have pressed the engine builders into putting out high compression ratio engines long ago. The sale of "octane numbers" as a separate item (Vitane) provides such an incentive. The profitable sale of anti-knock quality only to people who want it and can utilize it should rapidly take the limitations off increasing compression ratio with benefits to all concerned.

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* * *

NEWS

Refinery Near Completion

The extensive modernization program of the Socony-Vacuum Oil Company's East St. Louis, Missouri, refinery is nearing completion and will add 50 per cent to the plant's capacity for production of motor and diesel fuels, heating oils and other products, C. P. Baker, plant manager, announces. Texas crude is received via a new pipe line, crude capacity is raised from 21,000 to 30,000 bbl per day, gasoline (motor fuel) capacity is boosted from 11,000 bbl per day to 18,000 bbl per day. A new TCC cracking unit is installed for improving quality of motor fuels as well as other fuel fractions. Old Mississippi River-dock facilities are replaced with an all-steel dock extending 250 ft into the river, its level being 42 ft above mean water level. The plant employs almost 500 people.

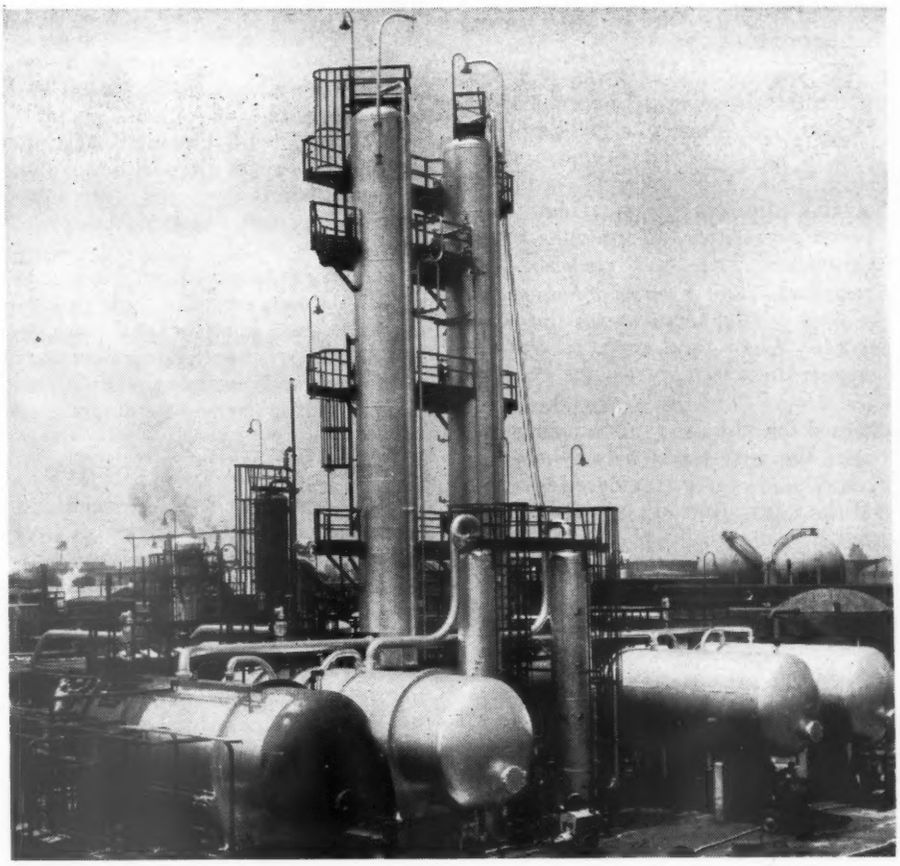
Acquire Refinery Site

Imperial Oil has acquired a refinery site of about 400 acres on the east bank of the Red River on the outskirts of Winnipeg, Canada, the company announced.

Actual engineering plans are now being completed, however, no decision has been reached as to when work will commence. Plans for the project are being developed with J. S. McDiarmid, minister of mines and resources, R. E. Grose, director of the department of industry and commerce and other provincial, city, and municipal officials.

Construction Underway On Stanolind Plant

With a capacity for handling 100,000,000 cu ft of natural gas daily to recover 311,000 gal (7400 bbl) of liquid products the new natural gasoline plant being built by Stanolind Oil and Gas Company in North Cowden Field, West Texas, is well under way on construction, by Stearns-Rogers Construction Company of Denver, Colorado. Owners of the plant include other companies operating in the field. Stripped gas will be returned to the field under elevated pressures to maintain production pressures in the horizon. This project represents a 24-year high-pressure gas injection program including practically the entire field. Among the equipment assemblies supplied to the plant are nine large GE electric motors, several small motors, with two 721-hp mechanical drive turbines and generators for a power station to supply 4000 kw of electrical energy.



Part of the new equipment going into the refinery of the Socony-Vacuum Oil Company, Inc., at East St. Louis, Illinois, as part of a modernization and expansion program, is this solutizer unit that removes sulphur from high grade gasoline by means of a caustic solution. With completion of the construction program, this refinery will be one of the most modern and flexible in the Midwest.

Offer Petroleum Courses

University of California is offering this fall, courses in petroleum map drafting, petroleum refinery equipment, and petroleum refinery engineering.

Instructor in map drafting is H. F. Peterson, department manager, surveying and drafting department of Shell Oil Company. Paul W. Morgal will conduct the equipment course and H. F. Wilkinson, engineer with Union Oil Company, will conduct the engineering class.

Complete New Refinery

Cities Service Oil Company (Delaware) is completing at its East Chicago, Indiana, refinery a modernization and expansion program at an approximate cost of $20,000,000. The program includes a new delayed coking unit, a "cat" cracker, minor processing units and auxiliary projects. An open house and plant tour was held September 14 and 15 for Cities Service dealers and distributors served by this plant and for Chicago area employees of the company.

Get New Cracking Unit

The major construction program recently announced for the Perth Amboy, New Jersey plant of the California Refining Company will include a 25,000 bbl per day Houdriflow catalytic cracking unit, it was disclosed by Brigadier General D. N. Hauseman, president of Houdry Process Corporation.

Opens New Refinery

Continental Oil Company held open house at its new $9,500,000 refinery in Billings, Montana, October 8. The new refinery, Continental's largest and northernmost plant in the Rocky Mountain states, will have a daily crude oil capacity of 7500 bbl. The plant wil employ about 150 men and will have a payroll of approximately a half million dollars annually.

Comprising the modern processes of catalytic cracking, catalytic desulphurization and polymerization and solvent extraction of asphalt, the plant will manufacture a high octane gasoline and a full line of burning fuels and residual oils.

New Name for Temperature Scale

The name "Celsius" was adopted by the Ninth General Conference on Weights and Measures in October, 1948, in place of the more common term "Centigrade" widely used in English-speaking countries. The French authorities substitute the word "Centesimale" used in French law, for Centigrade. The French language is the only official language of the conference. When time came to choose between these two words, the conference chose "Celsius" instead. It is claimed that the need for choosing between the two terms arises only in French, and is not considered to control the terms used in translating into other languages.

Pilot Plant Installed to Study Odorant Problem

A pilot plant has been installed at the Southern Counties Gas Company's Brea-Olinda station to test processes for removal of mercaptans from Texas gas. The plant handles up to 2,000,000 cu ft of gas a day and is flexible enough to test any fixed-bed process for removal of mercaptans that cause an objectionable odor in the gas. The program is under the direction of J. L. Oberseider, consulting engineer.

Four processes are being tested. These were all previously tested and screened in the laboratories at Santa Fe. While the pilot plant operations are under way at Brea-Olinda, other processes will be screened at the laboratories for further testing in the pilot plant.

The pilot-plant project expects to supply enough data on each process to make cost comparisons possible, and also to provide the data necessary to design and engineer a full-scale plant if that is deemed necessary.

Refiners Group Reorganized

Gulf Coast Refiners Association has been reorganized by a group of Gulf Coast independent refiners representing refinery capacity of approximately 200,000 bbl a day. Headquarters of the organization, which functioned for a number of years prior to its dissolution in 1946, will be in Houston, Texas.

D. W. Hovey, president, Danaho Refining Company, was elected president of the association, and John Homman, Jr. of Homman Oil and Refining Company, was elected secretary-treasurer.

Predicts Adoption of Automatic Transmission

New development in the automatic transmission field will force all important automative manufacturers to adopt these units within the next three years in order to remain competitive, Walter Hochuli, Texaco's general sales manager, predicted in a press conference at The Texas Company's Chrysler Building offices.

As auto makers introduce the new transmissions, they will devote 30 per cent of their production to cars containing the units during the first year, but that percentage will rise to 90 per cent within four years and remain at that figure thereafter, he predicted.

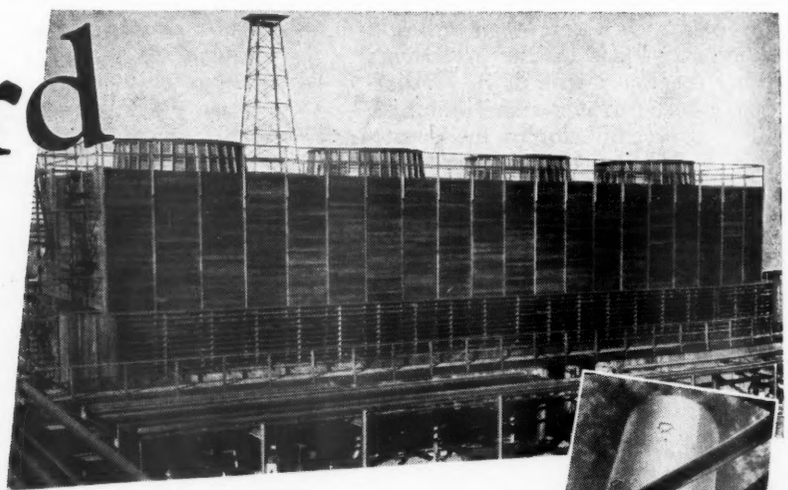
Mr. Hochuli stated that, excluding the Chrysler type of fluid drive, there are already 2,000,000 automatic transmissions on the road, and this number will jump to 3,000,000 units within 18 months.

Named Manager

Fred J. Underwood, formerly project manager in charge of erection of Imperial Oil, Ltd.'s refinery at Edmonton, Alta, Canada, for W. M. Barnes Company, constructors, has been named manager of the new Edmonton office of the Barnes Company.

Pritchard

COOLING TOWERS



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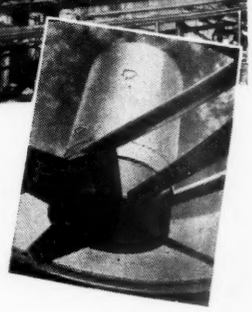

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NEWS

Humble's Pickton Plant Operating

The 30,000,000 cu ft per day natural gasoline and gas repressuring plant of Humble Oil and Refining Company at Pickton is in operation, and will process 18,000,000 cu ft of gas daily, company officials announced. It is a conventional oil-absorption type unit operating a 700 psig design pressure. This unit operates on gas-well gas from the Yantis field and on casinghead gas from the Pickton oil field. The stripped gas will be compressed and returned to the Pickton field horizon at about 2700 psig.

The unit will produce about 13,250 gal per day of propane for LPG, 11,500 gal of butane mainly for the same purpose, and about 9000 gal of natural gasoline. The plant area includes a truck loading dock, and storage capacity for five days' production of liquids. A 20-car railroad loading rack is provided two miles from the plant. The plant was built by the Fluor Corp., and includes 2100 hp of gas-engine-driven compressors, along with 600-hp boiler capacity and 500 kw of electric generating capacity. Employee housing facilities are provided and the plant is under the direction of W. A. Hutsell, superintendent.

Wins Cash Award

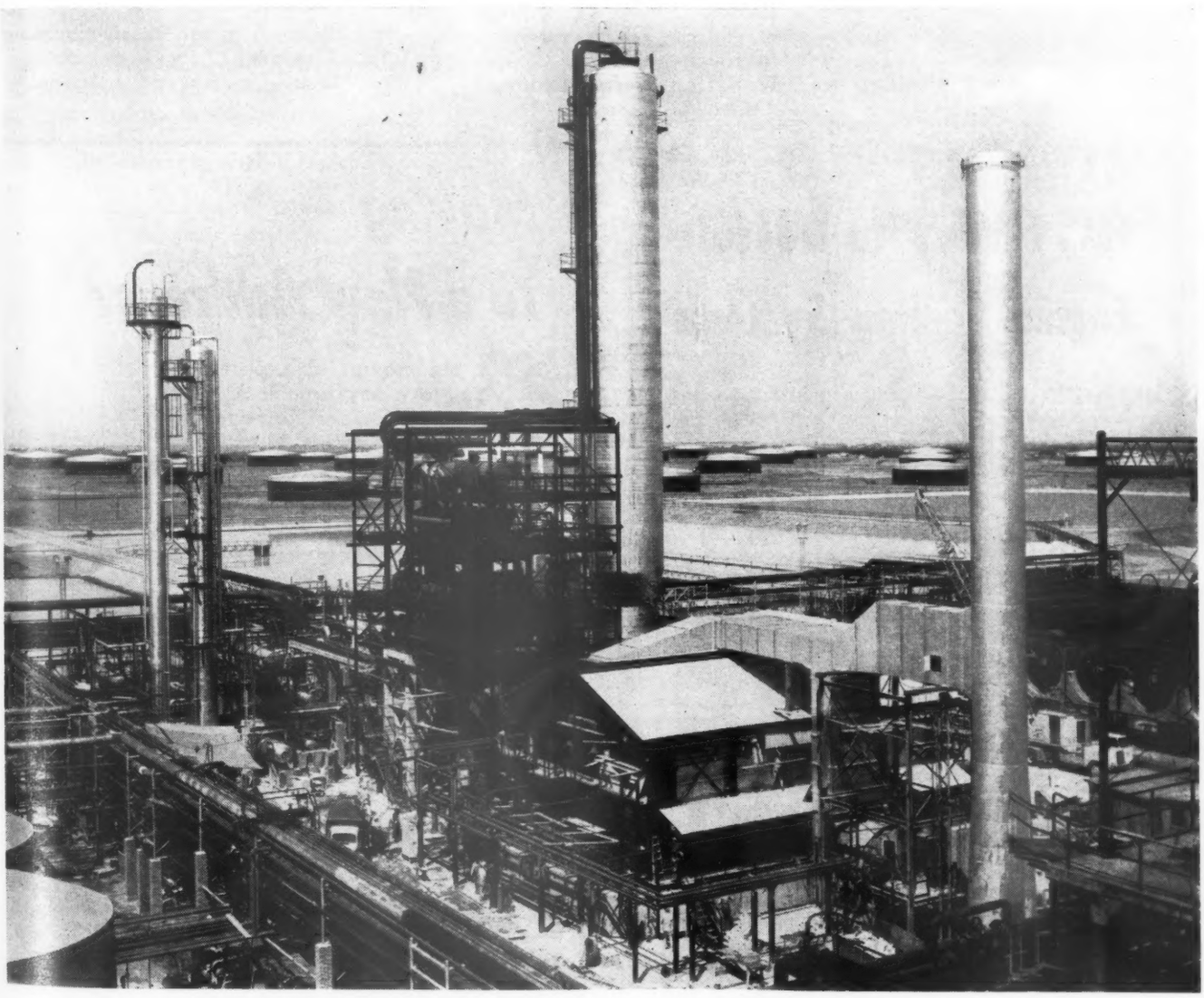
The 10,000th idea submitted by employees of the Bayonne refinery of the Tide Water Associated Oil Company since inception of its Suggestion Plan 24 years ago, has earned a cash award for its author, John P. O'Grady. O'Grady received the award at a ceremony presided over by Frank W. Keebler, assistant general superintendent of the refinery. O'Grady has been with the company 22 years.

Gets New Topping Unit

A new 30,000-bbl-per-day crude topping unit will go on stream at Continental's Ponca City, Oklahoma, refinery on September 26, according to announcement by L. F. McCollum, president. This unit is part of the $8,000,000 expansion program at Ponca and boosts the crude running capacity from 33,000 bbl per day to 52,500. Additional facilities include a water cooling system, gasoline treating capacity, crude desalter unit, and complete refinery pipe line and tankage rearrangement.

In this new crude unit the fractionator is 145 ft high, weighs 230 tons, is fitted inside with alloy cladding, and stainless steel and monel, to combat corrosion by West Texas and Kansas crudes on which it will operate. The company's further plans include modernization of the Thermofor catalytic cracking unit, built for the government during the war and since then bought by Continental.

Continental Oil Company's Ponca City, Oklahoma, refinery goes on stream.



Install Houdriflow Unit

Award of contract to the Bechtel Corporation of San Francisco for design and construction of a multi-million dollar catalytic cracking unit has been announced by the Salt Lake Refining Company, subsidiary of Standard Oil Company of California.

The new unit, a Houdriflow Process cracker, will be built as part of a $10,000,000 expansion of facilities of the Salt Lake, Utah, refinery. Field construction is expected to begin early in 1950, with completion scheduled by the end of next year.

The new cat cracker will be fed straight run waxy gas oil from the refinery's existing crude unit. Its rated capacity is 10,000 bbl per stream day, from which it will make approximately 4000 bbl cracked gasoline.

French Plants Being Built

Reconstruction of three French refineries, at a cost of $20,435,000, is planned by the Economic Cooperative Administration, announcements in Washington and in Paris state. Nearly $4,000,000 of this money will be in ECA dollar funds, the remainder in francs, it is stated.

The Donges refinery, near St. Nazaire, France, owned by a French company, Raffineries Francaises de Petrole de L'Atlantique, which was damaged seriously during the war. Two important jobs are planned in this plant, to cost nearly $10,000,000; the total crude capacity is to be increased and the lubricating oil capacity will be raised from 14,000 metric tons to 38,000 metric tons per year. Crudes from the French share of Middle East production, will be processed.

Two plants owned by Compagnie Francaise de Raffinage, another French company, at Gonfreville in Northern France, and at La Mede near Marseille, will be modernized. At Gonfreville lubricating oil equipment will be installed to produce 120,000 metric tons of lubricating oils and 10,000 metric tons of wax per year. Cracking units at La Mede will be modernized to permit the processing of distillates from Middle East crudes. The cost of these two projects will be about $11,000,000, of which $3,150,000 will be ECA funds.

Holds Technical Meeting

Western Petroleum Refiners Association will hold a one-day mechanical meeting at the Palmer House, Chicago, Illinois, October 21. Waste disposal in refineries will be presented by L. C. Burroughs, Shell Oil Company, and W. B. Hart, Atlantic Refining.

Hydrocarbon Samples Ready

U. S. Bureau of Standards and the American Petroleum Institute cooperative program has prepared to date a total of 169 hydrocarbon compounds which are now available as NBS standard samples. These are employed by industry for calibrating analytical and other instruments and apparatus for research and experimental work, used mainly by the petroleum, rubber, chemical, and allied industries. Seven new additions to the list, previously announced, are available from the Bureau in Washington:

NBS sample number[1]	Compound formula	Compound name	Amount of impurity[2]	Volume per unit[3]	Price per unit
			mole percent	ml (liquid)	
573-5S	$C_{13}H_{28}$	n-Tridecane	0.09±0.06	5	$35
526-5S	C_6H_{12}	cis-2-Hexene	0.20±0.12	5	35
574-5S	C_7H_{14}	4,4-Dimethyl-trans-2-pentene	0.09±0.03	5	35
575-5S	$C_{10}H_{14}$	1,2,3,5-Tetramethyl-benzene	0.08±0.02	5	35
576-5S	$C_{11}H_{16}$	1-Methyl-4-tert-butylbenzene	0.05±0.03	5	35
577-5S	$C_{10}H_8$	Naphthalene	0.04±0.03	5	35
579-5S	$C_{11}H_{10}$	2-Methylnaphthalene	0.09±0.06	5	35

[1] The designation "-5S" following the sample number indicates a sample of 5 ml sealed "in vacuum" in a special Pyrex glass ampoule with internal "break-off" tip.
[2] The purity has been evaluated from measurements of freezing points, as described in J. Research NBS 35, 355 (1945) RP1676 unless otherwise indicated.
[3] Tolerance approximately ± 10 per cent.

Instructions for transferring standard samples "in vacuum" are available upon request to the Bureau.

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ACS Reveals Petroleum Research Costs Mounting

The petroleum industry spends four times as much money now on research as it did 10 years ago, W. E. Kuhn, chairman of the petroleum division of the American Chemical Society and manager of the technical and research division of The Texas Company told the assembled chemists at the 116th national meeting of the society September 19 at Atlantic City, New Jersey. The amount now being spent annually exceeds $100,000,000, Kuhn announced.

In spite of the fact that this "plowback" of funds has increased so greatly, petroleum products prices are only 20 per cent above those of 1926. More than 5000 products have been made to date from the hydrocarbon raw material, Kuhn said. At the same time food prices are up 80 per cent, building materials costs have doubled, and general commodity price level is raised 60 per cent. Remarkably enough this reinvestment of earnings in research is greater than that of steel, chemical, electrical, and lumber and wood products industries. Not counting the money spent by the Federal Government, of a specialized nature, this increase is greater proportionately than that for all industry.

Outstanding in this meeting of petroleum chemists were the two symposia, on Adsorption Techniques, and on High Polymer Chemistry. Thirty papers were given in the adsorption symposium, discussing the various phases of this relatively new and increasingly important tool of the petroleum chemist. One of the more important developments in this field is that of the recovery, or concentration of specific hydrocarbons or groups of hydrocarbons from mixtures of low-boiling components by the use of activated charcoal, or carbon, as in the Hypersorption Process. This process recovers materials such as ethylene from mixtures with other gases and which is employed in numerous chemical syntheses at present. These syntheses have increased in number so rapidly that many enthusiasts believe that the total value of chemicals that are petroleum-derived will exceed the value of the primary petroleum products, a situation that is not likely to occur. It is significant, however, that the number of commercial organic chemicals from petroleum is increasing very rapidly.

Another phase of petroleum research is that of High Polymers on which a large number of research organizations are expending much effort. These polymers include plastics, the all-important synthetic rubber that made victory possible in World War II, fibers and other materials, which were discussed in great detail at the meeting.

On September 19 the petroleum division presented to Bruce H. Sage, of the California Institute of Technology, the first Precision Scientific Company Award in Petroleum Chemistry, for his outstanding researches in this field. Sage addressed the presentation luncheon meeting on "Status of Thermodynamics in the Petroleum Industry."

Other important meetings were those on Chemical Literature, Organic Chemistry, and the Petroleum Division session on the Nomenclature of Hydrocarbons, a highly involved situation in which strong efforts are being made to clarify and simplify the system employed by the industry. Especially interesting is the disclosure by W. J. Zimmerschied, R. A. Dinerstein, A. W. Weitkamp, and R. F. Marschner of Standard Oil Company of Indiana's research department, that the combination of urea, oldest of all synthetic chemicals, with paraffin hydrocarbons to form solid crystalline substances can be isolated and from this compound the original hydrocarbon can be identified. * * *

Phillips Resumes Making Diisopropyl Alkylate

Resumption of operations to make diisopropyl alkylate from isobutane and ethylene by catalytic methods is announced by Phillips Petroleum Company. The ethylene alkylation plant was built during World War II to make high octane aviation fuel alkylate and its operation was suspended shortly after the war ended. The unit has been modernized, and will be operated as a part of the company's facilities at Phillips, Texas.

In addition to high octane ratings and volatility, in motor fuels the alkylate improves both road and laboratory specifications and performance, it is claimed.

Hold Annual Dinner

The Association of Consulting Chemists and Chemical Engineers, Inc., has adopted a new policy of "open-door meetings." Representatives of industry and non-member professional men will attend the 22nd annual dinner meeting, October 25, Shelburne Hotel, New York City.

The guest speaker will be Robert A. Whitney, president, National Federation of Sales Executives, on "Better Selling—the Catalyst of Our Economy."

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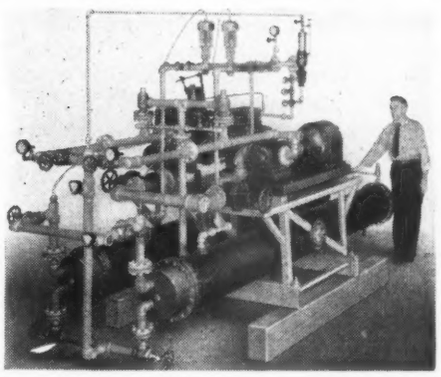

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PERSONALS

Clark S. Teitsworth

Clark S. Teitsworth, who became director in charge of manufacturing for the Socony-Vacuum Oil Company, Inc., on July 1, 1947, is an enthusiastic golfer who manages to average in the 80's "toward the latter part" of each season but for whom the lure of the fly-rod is just as great as that of the links.

Each year he manages a brief stay in Wyoming when the mountain trout are at their bitin'-est, not only stowing away his golf clubs for this period but also deserting his prize delphiniums and other flowers at his six-acre home in bustling Plainfield, N. J. Almost all of the six acres are devoted to flowers, vegetables, and fruit trees, which is an unusual enterprise in the center of even a suburban community.

Although he was born in Minneapolis, Minnesota, Teitsworth is nearly that rara avis—a California "native-son." His family moved with him to California when he was only a year old. Subsequently he attended Stanford University, became a "Red Shirt" graduate in 1919 with a BA degree. He then attended the graduate schools of the University of Minnesota and the California Institute of Technology. An intervening year was spent in the U. S. War Department's Fixed Nitrogen Research Laboratory at Washington.

After completing his formal education in 1923, Teitsworth joined the Celite Company at Lompoc, California, for three years, and then began with the General Petroleum Corporation at Los Angeles as a chemical engineer in the process laboratories.

Made assistant manager of the laboratories in 1930, he went to Socony-Vacuum's headquarters in New York three years later on a special assignment to determine whether catalytic cracking was developed sufficiently for commercial application in Socony-Vacuum's refineries. He was a member of Socony-Vacuum's Manufacturing Committee from 1935 to 1940 and vice chairman from 1940 until five years later when he became chairman.

One of Teitsworth's sons, Richard, 22, a recent graduate of Yale University, is with General Petroleum at Los Angeles, and another, Robert, 17, is a student at Stanford. Mr. and Mrs. Teitsworth live at 1301 Cushing Road, Plainfield. He is a member of the Plainfield Country Club and the American Chemical Society.

▸ **Julius D. Heldman** has recently been transferred to the research laboratory at the Houston, Texas, refinery of Shell Oil Company, where he will be general program adviser to the research director. He was formerly chief research chemist at the company's Wilmington laboratory.

Heldman took his undergraduate work at U.C.L.A., leading to an A.B. in chemistry in 1939 and an M.A. the following year. In 1942 he obtained his Ph.D. degree from Stanford University, and was thereafter in succession a National Research Council fellow and an instructor in chemistry at the University of California at Berkeley. During the war he was connected with the Manhattan Project at Berkeley and Oak Ridge. He joined the company in 1945 as technologist in the manufacturing development department.

▸ **Dr. John Happel,** professor of chemical engineering at New York University in New York City, has been appointed chief of the department of chemical engineering of that institution, Dean Thorndyke Saville has announced. Dr. Happel has been a full professor at the University since 1948. He graduated from Massachusetts Institute of Technology in 1929, received his Masters' degree in chemical engineering in 1930, and was a member of the technical staff of Socony-Vacuum Oil Company, Inc., for more than 15 years. His doctor's degree was received from Brooklyn Polytechnic Institute. He is well known in chemical engineering circles for his work on product treating, petrochemicals, synthetic rubber ingredients, and in other fields.

▸ **R. L. Davis,** Shell Oil Company, Inc., has been named manager of that company's gas-gasoline department in the New Orleans, Louisiana, exploration and production area. He is succeeded by **L. J. Snyder,** as manager of the gas department in the company's Houston refinery.

W. M. Frech succeeds Snyder as manager of the alkylation department of the Wilmington, California. **S. F. Good,** formerly assistant manager, succeeded Frech as manager of the gas department at the company's Norco, Louisiana, refinery.

▸ **Bernard C. Ryan,** assistant head of operations analysis at Esso Standard Oil Company's Bayonne, New Jersey, refinery, was recently named section head in charge of distillation, cracking, heat exchange, and combustion at the company's Bayway refinery, Linden, New Jersey. He has been replaced by Wilbur V. Hunt at the Bayonne plant. **Robert E. Meskill,** engineer in the operations analysis department at the Bayonne plant, will replace Hunt.

▸ **Raymond B. Cross** has been named manager of the Houdry Process Corporation's Paulsboro, Pennsylvania, catalyst plant. Cross, who has been with the Houdry Corporation for 13 years, went to Paulsboro as chief chemist when the plant went into operation in 1940.

He is a native of Pennsylvania with Butler as his home town. He attended the University of Detroit in Michigan and further schooling took him to Grove City College in Pennsylvania where he received his Bachelor of Science degree. Cross replaces **A. R. Worrall,** former manager of the plant, who is leaving the Houdry Corporation to accept a position with the Davison Chemical Corporation in Baltimore, Maryland.

▸ **G. Clifford Johnson** has been named superintendent in charge of mechanical departments at Sun Oil Company's Marcus Hook, Pennsylvania, refinery. He previously served as assistant superintendent in charge of maintenance and construction.

Clarence Pierce also employed at the Marcus Hook refinery has been elected commander of John McKenna-Sun Oil Post 660, American Legion, at Linwood, Pennsylvania.

C. K. Buell, assistant manager of Phillips Petroleum Company's chemical engineering department, presented a paper, "Ethylene Production by Thermal Cracking of Propane-Ethane Mixtures," at the 75th anniversary celebration of the Colorado School of Mines, September 29 to October 1 at Golden, Colorado.

After joining Phillips following his graduation from Colorado School of Mines in 1939, Buell was appointed liaison engineer between the research and development department and the defense plant division of the natural gasoline and gas department. He became assistant manager of the chemical engineering department in 1948.

L. J. Weber, co-author of the paper presented by Buell, has been with Phillips since 1936, joining the engineering department after graduating from Colorado A. & M. with a mechanical engineering degree.

David M. Liles has been named superintendent of Stanolind Oil and Gas Company's Stano gasoline plant, near Ulysses, Kansas, it was announced by C. T. Jones, Central division manager.

Liles succeeds C. J. Tighe, who is transferring to Andrews, Texas. Liles was plant foreman of the Stano plant, going to Ulysses last December. He is a 20-year man with Stanolind and is a veteran of gasoline plant, cycling plant, and refinery operations. He went to Stano from the Gilliam gasoline plant, Vivian, Louisiana, and has also worked at Stanolind's Jennings, Louisiana, recycling plant and its Superior refinery, Vivian, Louisiana.

D. B. Warner will replace Liles as foreman at the Stano plant. Warner was an operating engineer in Stanolind's Tulsa general office for the past year, transferring there from the Salt Creek, Wyoming, gasoline plant. He has a BS degree in chemical engineering from the University of Colorado.

John P. Purcell has been promoted to the position of chief engineer of The Bahrein Petroleum Company Limited at its Bahrein, Persian Gulf refinery.

Purcell succeeds **Carroll A. Southwell** who is now on assignment with California Texas Oil Company Limited in Holland.

Leigh D. Josephson has been appointed superintendent of personnel of The Bahrein Petroleum Company, Limited, at its Bahrein, Persian Gulf refinery. Josephson, whose former position was assistant refinery superintendent, has been stationed at Bahrein since 1939.

James Baadsgard, foreman in the can factory at the Whiting refinery of Standard Oil Company (Indiana), celebrated conclusion of 50 years of service October 1.

In honor of the occasion M. G. Paulus, vice president in charge of manufacturing, awarded Mr. Baadsgard a gold watch from the board of directors at the general office of the company in Chicago. Baadsgard will retire on company annuity March 26, 1951, when he is 65 years old.

All of Baadsgard's half century of service with Standard has been spent in the can factory at Whiting. He was promoted to foreman in the can factory in the early 20's.

Stanley Chaberek, Jr., Ph.D. graduate of Clark University, has joined the research staff of the Houdry Process Corporation at Linwood, Pennsylvania, as assistant research chemist. Chaberek received the B.A. degree from Clark in absentia, while in the Armed Forces; worked two years after leaving the service in 1946, and was granted a Master's degree while teaching organic chemistry at Assumption College, Worcester, Massachusetts. His special training in service, at Brown University and MIT was in meteorology.

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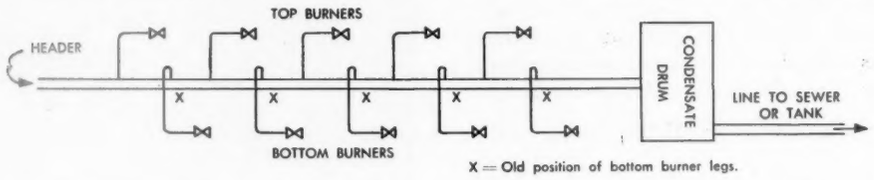
Reduction of Burner Fouling and Stopping

The lower series of burners in a burner assembly on a pipe still, fed from a common fuel header which serves also the upper tier of burners, as to take off also from the top side of the header, curve through 180 deg and extend as before to feed the lower tier of burners. With this arrangement all



X = Old position of bottom burner legs.

often become fouled and stopped by BS&W, solids, etc., which drop into the legs that take off from the lower side of the fuel header. To solve this and arrange these burners so they will not foul more quickly than those whose legs take off from the top of the header line, the legs are rearranged so solid or clogging material settles to the bottom of the header and is flushed out or removed when the aforesaid header is cleaned at some interval. The mark X on the drawing shows the exit position of the legs for the lower burner tier before changing the legs. —(Kersh).

How Much Will That Gasket Cost You?

The chances are, you can't answer the above question. Why? Because gaskets are usually given insufficient consideration by buyers. When one stops long enough to concentrate on gaskets and considers the important role they play in the piping world, in carrying steam, water, all kinds of gases and liquids, low and high pressure, it becomes perfectly plain that a poor gasket may be a decidedly expensive piece of equipment and that a first class gasket may be a great money saver.

Poor gaskets are likely to spring a leak very soon after they are installed. Some of them leak all the time beginning immediately after installation. In other words, they are never tight. Take a gasket of this latter kind. If its function is to seal steam pipes carrying high pressure steam, it can easily lose enough steam in one day to more than pay for a good gasket of much higher price.

In an effort not to exaggerate, let us assume that the cost of the poor gasket is 50 cents and that the loss of steam per day is 10 cents. Assuming 300 working days per year, the cost of leakage of steam per year is therefore $30. And if the leaky gasket is not replaced for 15 years the total loss during that period becomes $450.

Should conditions by the end of the first year become so bad that it is decided to put in a new gasket of the same inferior quality every year at a renewal cost of, say $4, per change for labor, the cost would be $60, for the labor and $7.50 for 15 gaskets, or a total loss of $67.50. This added to the $450, gives us $517.50 as the total cost of a poor 50-cent gasket. The cost of labor also depends largely upon the gasket, often becoming an expensive proposition if the gasket should happen to stick to the flange. In some instances sticking has necessitated taking down entire sections of pipe so that the flange could be properly cleaned.

Obviously it pays to invest $1 in a good gasket rather than 50 cents if the dollar gasket will prevent leakage and will stay tight for a long period of time.

Gaskets sometimes blow out completely, or are ruined by superheated steam, and as a result actually cause plant shut-downs holding up hundreds or thousands of employees at a tremendous expense to the owners. Thus, such a loss might occur at the end of the above 15-year period and the loss would have to be added to the $517.50—almost unbelievable, yet it is entirely possible. Poor gaskets are expensive.—W. F. S.

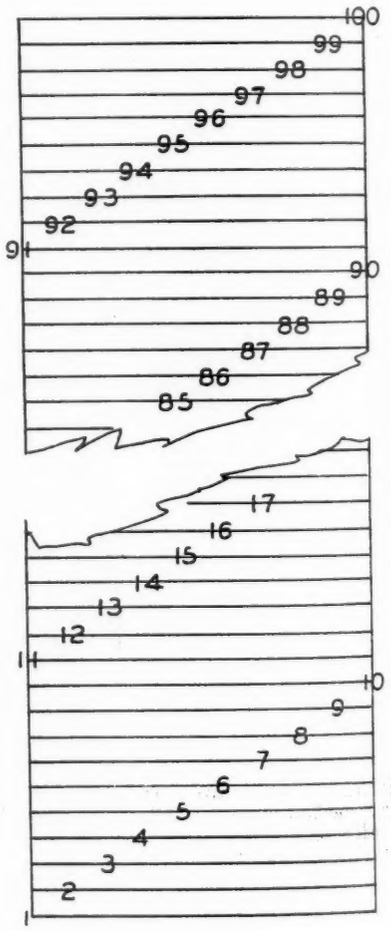
Valve Opening to Clean

Due to caking and clogging of catalyst in the tubes of a waste gas cooler on a fluid catalytic cracking unit slowed the throughput of gas until the exit temperature dropped from 700 F to 180 F. To permit partial cleaning of this exchanger without cutting the cooler out of service, an 8-in. gate valve was installed in the outlet duct of the cooler, immediately above the tube sheet in the center thereof.

By opening this valve, cleaning equipment can be inserted in about 50 per cent of the vertical cooler tubes below it. Installing more than one valve will permit cleaning of practically all the tubes, without opening the cooler. As result of use of this one valve and dislodging the caked catalyst from the tubes, the exit gas temperature rose to 575 F from about 180 F.—(C. E. Compton).

Mass Spectrometer Charts

A section of ruled paper, such as chart paper, is laid out in groups of 10 divisions, as shown in the accompanying drawing. This section is glued to a ruler having a beveled edge, for easy handling. The scale can be



placed directly on the chart, with its zero coinciding with the zero of the recorder, and the peaks of the various parts of the recorded curve may be read directly.—(A. W. Josek).

Subcommittee on Construction

A WORK that will be of great value to pipe line operating companies and contractors alike is now ready to get under way in earnest. This is the preparation of a bulletin by a committee of the American Petroleum Institute on recommended practices for pipe line construction, which will include appendices on typical construction specifications and contract provisions.

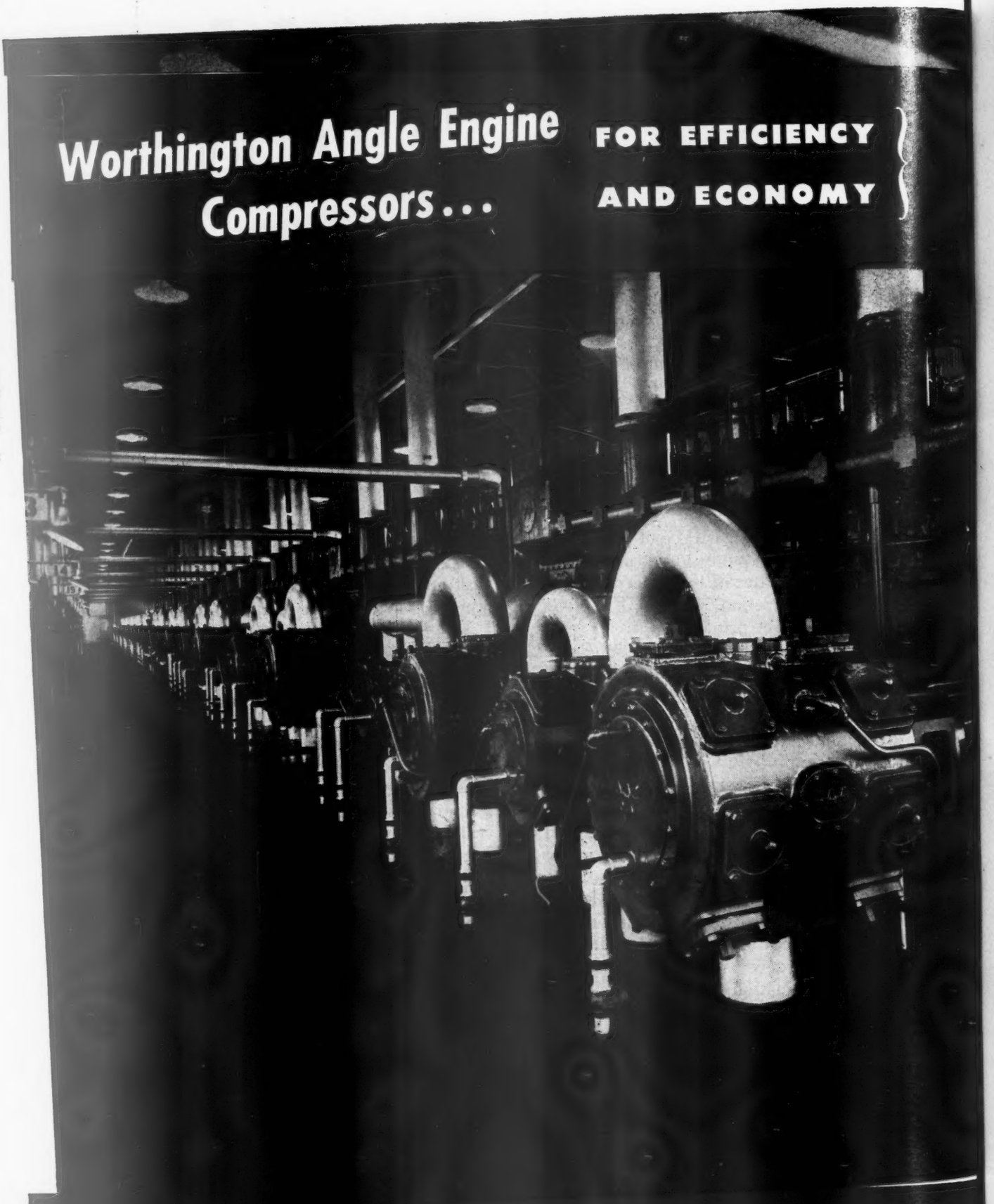
The appointment of a Subcommittee on Pipe Line Construction Practices by the Committee on Pipe Line Technology is the result of a resolution approved last November by the Central Committee on Pipe Line Transportation and voted upon favorably by letter this spring. Names of those who will serve on the committee have recently been announced and the decks are cleared for action, so to speak.

The bulletin will consist of three sections: (1) A discussion of generally-accepted good practices in the laying of oil pipe lines, including such matters as clearing rights-of-way, ditching, stringing pipe, welding, preparing pipe for coatings, application of coatings, testing of coatings, installation of casings, lowering-in pipe, pressure testing, backfilling, etc.; (2) Typical paragraphs, suitable for inclusion if desired in construction contracts, giving specifications on the physical features enumerated above; and (3) Typical paragraphs, suitable for inclusion if desired in construction contracts, covering such "general conditions" as responsibility for obtaining permits and compliance with various laws, ordinances, etc.; contractor's performance bonds; liabilities and insurance; supplying of materials; inspection techniques; subcontract approvals, and termination provisions.

Members of the new subcommittee, consisting of 19 members, were appointed by H. H. Anderson, chairman of the Committee on Pipe Line Technology, after first requesting nominations from executives of 26 oil and products pipe line companies, thereby assuring procurement of the best pipe line talent available for the task. The subcommittee is fortunate, too, in having as its chairman H. E. Fisher, chief engineer, Pipe Line Department, Standard Oil Company (Indiana). Mr. Fisher already has made an extensive study of the problems of formulating suitable construction specifications and contract provisions. Thus the subcommittee will have a good foundation upon which to build.

J. H. Love

Worthington Angle Engine Compressors... FOR EFFICIENCY AND ECONOMY



10,000 hp... in this line of ten Worthington Type LTC-8 Angle Engine Compressors. These units, in gas processing service, were installed by Celanese Corporation of America, in their plant in the Corpus Christi area.

EXCLUSIVE

Foreign Pipe Line Outlook

FRANK H. LOVE*

PIPE lines under construction and planned in foreign countries total 14,927 miles. Of this total 7530 miles will be for crude oil transportation service, 6073 miles for gas, and 1324 miles for products. Breaking down these statistics still further 5335 miles apply to the Middle East, 4675 miles to Canada, 2443 miles to South America, 1655 miles to Mexico, 239 miles to France, 220 miles to Sweden, and 360 miles to Russia.

Middle East

The total mileage for the Middle East, 5335, is all scheduled for crude oil service. This area leads all others in pipe line mileage, as would be expected inasmuch as it has the greatest oil reserves in the world and pipe line outlets up to now have been limited.

With approximately 275 miles laid on the eastern end of the 1070-mile Trans-Arabian Pipe Line Company, work has now got under way on the western end. This line, which extends from the Persian Gulf to the Mediterranean, had been delayed awaiting an export license for steel pipe by the U. S. Department of Commerce and the granting of a concession by the Syrian government for the line to cross that country. The Department of Commerce granted the license some time ago and the concession also was forthcoming from the Syrian government. A military coup the middle of August that overthrew the regime of President Marshal Husni Zayim, which had granted the concession, has given rise to conjecture, however. Interim Premier Hasem Bey Atassi stated that his government was functioning as a temporary cabinet and would neither confirm nor deny actions taken by the overthrown government. The question will be left up to Syria's future parliament.

Meanwhile a construction camp is being erected at Sidon, Lebanon, at the western end of the line, which also will be the site of a refinery and tank farm. Shiploads of pipe began arriving at Beirut this month and previously shiploads of supplies had been received at this port. This important crude oil carrier, barring other unforseen delays, is scheduled for completion in January, 1951.

As part of the Kirkuk-Haifa line of Iraq Petroleum Company, Ltd., 383 miles of the 16-in. line were completed in July of this year and the line is being used for pumping oil. The 383 miles extend from K.3 pump station near the Euphrates crossing to Tripoli. This was tied-in to the 16-in. line previously laid from Kirkuk to K.3 station.

Middle East Pipe Lines, Ltd., also was granted a transit agreement by the Syrian government soon after one was granted to Trans-Arabian Pipe Line Company, and, of course, this agreement is beclouded by the recent change in that country's government. The Middle East Pipe Line will extend from Iranian fields to the eastern Mediterranean. The exact route of the line has not been determined as construction is not expected to begin until sometime in 1950. This line will be approximately 770 miles long and 34 and 36-in. pipe will be used, according to existing plans, which will make it

MIDDLE EAST

Company	Miles	Size, in.	Service	Status	Route
Trans-Arabian Pipe Line Co.	1070	30–31	Crude	Under construction	Abqaiq, Saudi Arabia, to Sidon, Lebanon
Anglo-Iranian Oil Co. Ltd.	50	20–22	Crude	Under construction	Agha Jari to Mashur, Iran
Iraq Petroleum Co.	1150	16	Crude	Under construction	Kirkuk, Iraq, to Haifa, Palestine, to Tripoli, Lebanon
Iraq Petroleum Co.	555	28–32	Crude	Planned	Kirkuk to Banias, Iraq.
Petroleum Development (Qatar) Ltd.	40	14	Crude	Under construction	Dukhan field to Umm Said
Kuwait Oil Co.	1100	30	Crude	Planned	Kuwait, Arabia, to Levantine Port
Kuwait Oil Co.	600	4–30	Crude	Under construction	Kuwait, Arabia
Middle East Pipe Lines, Ltd.	770	34–36	Crude	Construction to begin in 1950	Iran to Syria
Total mileage—	5335				

CANADA

Company	Miles	Size, in.	Service	Status	Route
Interprovincial Pipe Line Co. (Imperial Oil Ltd.)	450	16 or 20	Crude	Authorized	Edmonton, Alberta, to Regina, Saskatchewan†
Interprovincial Pipe Line Co.	750	16 or 20	Crude	Planned	Regina to Great Lakes
Imperial Oil Ltd.	85	4–8	Crude	Under construction	Redwater to Deron, Altamont
Queont Pipe Line Co.	330		Products	Planned	Montreal, Quebec, to Toronto, Ontario
West Coast Transmission Co., Ltd.	1400	30	Gas	Planned	Alberta fields to Vancouver and northern California‡
Northwest Natural Gas Co., Ltd.	950	24	Gas	Planned	Alberta to Vancouver to Northwest U.S.*
Western Pipe Lines, Ltd.	710	22–24	Gas	Planned	Alberta fields to Winnipeg

Total mileage—4675. Crude oil—1285 miles. Gas—3060 miles. Products—330 miles.

* Approximately 350 miles would be laid in Canada and 600 in the U.S.

† Application has been made to the government board of transport commissioners for permission to extend line to Gretna, Manitoba.

‡ What part of the total mileage shown will be in the U.S. and what part in Canada cannot be determined until the exact route and destination are announced.

*Transportation Editor.

the largest diameter crude oil line in the world.

South America

In Argentina, South America, the Direccion General del Gas del Estado (Argentine State Gas Service) has asked for bids to lay a 374-mile, 8-in. natural gas line from Plaza Huincul fields to General Conesa. The bids are to be opened this month. At General Conesa the line will connect with the one now being laid by the Argentine government from the Comodoro Rivadavia to Buenos Aires. Less than 100 miles remain to be laid of the latter and it is scheduled to be in operation some time in December.

Canadian Projects

The Interprovincial Pipe Line Company, a subsidiary of Imperial Oil, Ltd., for some time has had preliminary work under way on its 450-mile crude oil pipe line from Edmonton, Alberta, to Regina, Saskatchewan. Serious consideration is being given to extending the line to the Great Lakes area and there seems to be little doubt that this will be done. Where the terminus will be is still problematical. Imperial is considering extending the line from Regina to a point where it could serve the U. S. Midwest. Because there is considerable pressure on the part of U. S. oilmen to reduce imports, however, alternatives are being considered. One is to extend the line from Regina to Port Arthur, Ontario. Another is to extend it to Duluth, Minnesota, under bond and from there ship the oil by tanker to industrial cities in eastern Canada. Already Imperial Oil, according to reports, has made application to the government board of transport commissioners for permission to lay the line from Regina to Gretna, Manitoba, near the North Dakota border. Reports have it also that a line might be laid from Gretna to Winnipeg, Manitoba.

Three major gas pipe line projects are in the planning for Canada. Two expect to serve the same general consumer area, however, and it appears likely that only one will obtain government authorization. The two are the Northwest Natural Gas Company and Westcoast Transmission Company. They propose to take natural gas from Alberta to Vancouver and on into the Pacific Northwest.

Northwest Natural proposes a 24-in. line to serve Vancouver, Seattle, Portland, Spokane, and smaller cities along the route. The ultimate capacity of the line would be 222,000,000 cu ft a day. This line would cost approximately $100,000,000.

Westcoast Transmission Company plans a 30-in. line costing an estimated $175,000,000. Its officials look to a market demand in the Pacific Northwest and northern California of 500,000,000 cu ft a day.

Western Pipe Lines, Ltd., would lay its 22- and 24-in. line from Alberta east to Winnipeg, serving other cities and towns en route. This project would cost an estimated $48,000,000.

All three projects received a recent setback when Alberta's premier, E. C. Manning, stated that applications for export of natural gas from Alberta will not be given favorable consideration until it is shown to the satisfaction of the provincial government that gas reserves are sufficient to exceed domestic and industrial demands of the province. After Alberta's requirements are met shipment of gas outside the province will be permitted, priority, however, being given to Canadian requirements. It is possible, therefore, that a number of new wells may have to be drilled before gas production would be considered of sufficient volume to permit its release to pipe lines carrying it into the United States.

The accompanying table lists the principal foreign pipe line projects, with indication of their status, whether actually under construction, authorized, or in the planning stage, according to latest information available.

* * *

SOUTH AMERICA

Company	Miles	Size, in.	Service	Status	Route
Santos Jundiai Railroad	30	18	Crude	Planned	Santos to Sao Paulo, Brazil
Santos Jundiai Railroad	40	10	Products	Planned	Santos-Sao Paulo-Campines, Brazil
Yacimientos Petroliferos Fiscales de Argentina	400		Crude	Planned	Plaza Huincul to Bahia Blanca, Argentina
Direccion General del Gas del Estado	374	8	Gas	Bids asked	Plaza Huincul to General Conesa, Argentina
Direccion General del Gas del Estado	1100	10	Gas	Under construction	Comodoro Rivadavia to Buenos Aires, Argentina
Colombian Government	342	6	Products	Planned	Puerto Berrio-LaDorada-Bogota-Cartago, Colombia
Ministry of Petroleum of Colombia and Antioqua Railroad	107		Products	Planned	Puerto Berrio to Madellin, Colombia
Techint Pipe Lines	50	8	Crude	Planned	Cerro Manantiales to Caleta Clarencia, Chile

Total mileage—2443. Crude oil—480 miles. Gas—1474 miles. Products—489 miles.

MEXICO

Company	Miles	Size, in.	Service	Status	Route
Petroleos Mexicanos	145	12¾	Crude	Planned	Reynosa to Monterrey
Petroleos Mexicanos	285	12¾	Crude	Authorized	Poza Rica to Salamanca
Petroleos Mexicanos	160	10¾	Products	Authorized	Minatitian to Salina Cruz
Petroleos Mexicanos	205	16	Gas	Under construction	Monterrey to Torreon
Petroleos Mexicanos	260	20	Gas	Under construction	Monterrey-Tampico-Poza Rica
Petroleos Mexicanos, Mexican Gas Co., and Industrial Gas Co.	600		Gas	Planned	Reynosa to Mexico City

Total mileage—1655. Crude oil—430 miles. Gas—1065 miles. Products—160 miles.

FRANCE

Company	Miles	Size, in.	Service	Status	Route
Cia, des Pipe Lines Petroliers Francais	125	10	Products	Authorized	Le Havre to Paris
Regie Antonome des Petroles	114	6	Gas	Under construction	Toulouse to Bordeaux
Total mileage—	239				

SWEDEN

Company	Miles	Size, in.	Service	Status	Route
Svenska Enterprenad Aktiebolget	220		Products	Planned	Uddevalla to Vasteras

RUSSIA

Company	Miles	Size, in.	Service	Status	Route
U.S.S.R.	360		Gas	Under construction	Dashiva to Kiev

Getting ready for a "pull" at Ohio River crossing.

Construction of Texas-Ohio Gas Line

FRANK H. LOVE*

ONE of the major pipe line projects now under construction in the United States is that of the Texas Gas Transmission Corporation, which is laying a line from the Carthage field, Texas, to Middletown, Ohio, a total distance of 833 miles. From Carthage a 20-in. line extends to Sharon, Louisiana, and from that point to its terminus the system is of 26-in. pipe. The 26-in., which constitutes by far the greater part of the line, is better than half finished and will be completed in December, in time for the heating season. The 20-in. line will be in service by the first of January.

When the line from Sharon to Middletown (actually to Lebanon near Middletown) is completed gas will be taken at Sharon from the Little Big Inch line, now a part of the Texas Eastern Transmission Corporation system. This gas will be principally for delivery to the City of Louisville, Kentucky, and to the old Kentucky Natural Gas system, which serves Evansville, Indiana, as well as other towns and cities in southern Indiana and western Kentucky. The gas remaining after these commitments have been satisfied will go to the Lebanon station of Texas Eastern.

With completion of the 20-in. line the vast reserves of the Carthage field will be drawn upon.

During the first year of full operation the new line will be capable of delivering approximately 275,000,000 cu ft a day. Ultimate capacity will be approximately 400,000,000 cu ft a day.

Eventually the system will have ten compressor stations with a total of 68,800 hp. The initial program includes the construction of six stations this year. All stations are being designed so that additional power can be added as customer requirements necessitate greater capacities.

EXCLUSIVE

Company Organization

The Texas Gas Transmission Corporation was formed by merger of Memphis Natural Gas Company and Kentucky Natural Gas Corporation. The Memphis system consists of 640 miles of pipe line. The main line is two 18-in. lines that originate in the Monroe field, Louisiana, and extend through Arkansas, Mississippi, to Memphis, Tennessee, a distance of 211 miles. From the Monroe field a single 20-in. line extends to the Lisbon field, approximately 50 miles; whereas a 10-in. line extends from Memphis 118 miles to Jackson, Tennessee. This sys-

*Transportation Editor.

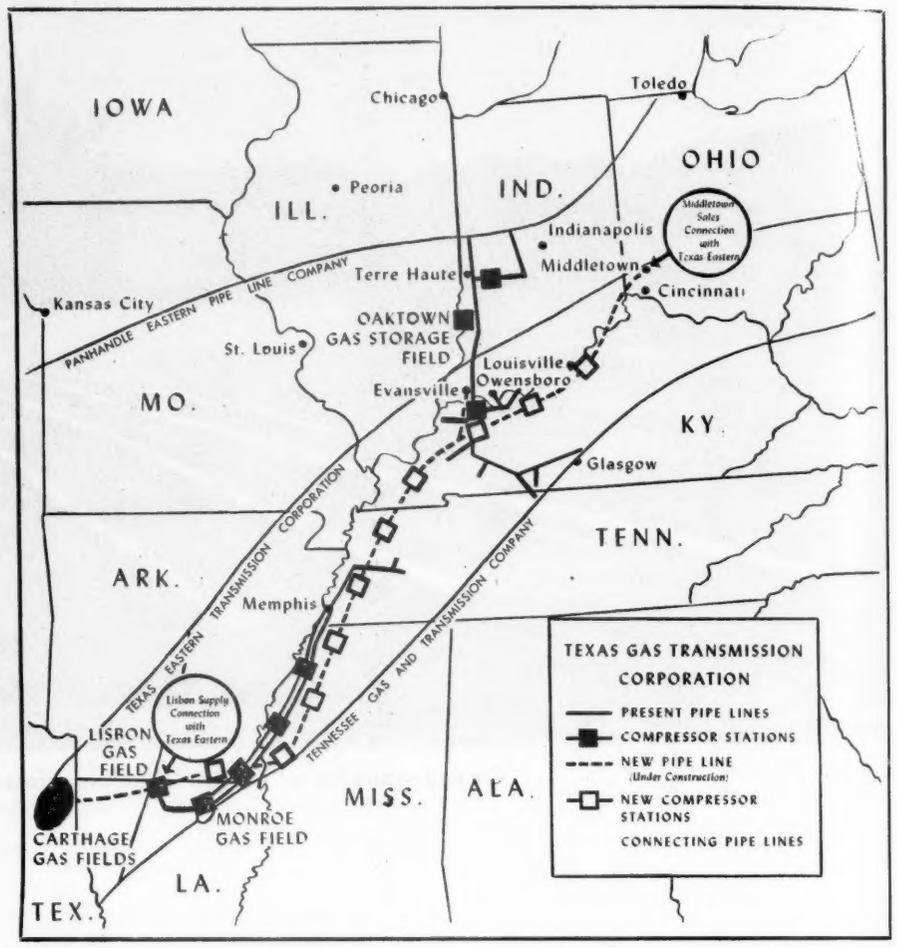
tem includes four compressor stations with a total of 23,390 hp.

The Kentucky Natural Gas System consists of 845 miles of pipe line and three compressor stations. This system has a 12-in. line that connects with the trunk line of Panhandle Eastern Pipe Line Company about 25 miles north of Terre Haute, Indiana, and extends 133 miles to Evansville, Indiana, where it is reduced to 10-in. in diam and passes east and south into western Kentucky to make a connection near Portland, Tennessee, with the Tennessee Gas Transmission Corporation. There are also numerous lateral lines. The Kentucky system also interconnects with the Big Inch and Little Big Inch lines of Texas Eastern Transmission Corporation.

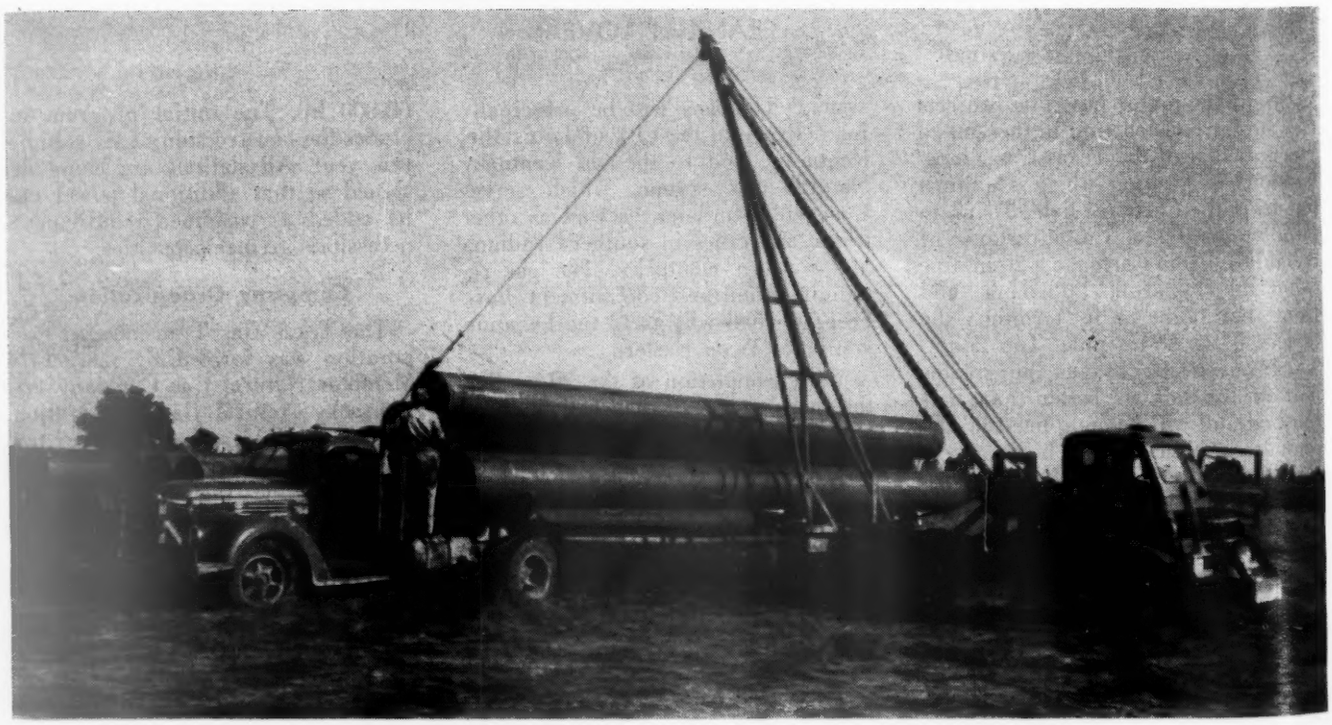
Contractors

In order to speed construction and have the line ready to deliver gas by cold weather, the construction work was divided among seven contractors on the main line. In addition, several special river crossing contracts were awarded. The following are performing the work:

N. A. Saigh Company, San Antonio, Texas, will lay the line from Carthage field to Sharon, Louisiana, 103.27 miles of 20-in. pipe. The contractor also will install on special contracts



In order to avoid, if possible, a shortage of pipe after construction began, Texas Gas had pipe shipped and stored at many points along the route before work began. Here pipe is being loaded onto a stringing truck at pipe yard in North Madison, Indiana.



the Red River and the Mississippi River crossings. The Mississippi River crossing is now under construction but delivery of pipe for the main line work will not begin until late in September, although clearing of the right-of-way will start prior to that time.

Latex Construction Company of Houston, Texas, has the 101.29-mile section from Sharon to the Mississippi River, near Greenville. This is 26-in. pipe, as is the rest of the line to Middletown except laterals and certain river crossings.

O. C. Whitaker Company of Fort Worth, Texas, takes up at the Mississippi River and is constructing the line to Lula, Mississippi, a distance of 36.17 miles.

The line between Lula and Memphis, 63.65 miles, was laid last fall and was used during the winter in connection with the Memphis Natural Gas Company system as a holder to shade the peak days at Memphis. N. A. Saigh Company laid approximately 33 miles of this section and J. R. Horrigan Construction Company 30 miles.

Between Memphis and Fulton, Kentucky, J. R. Horrigan Construction Company of Houston is laying 109.86 miles.

From Fulton to Slaughters, Kentucky, the 102.91-mile section is being constructed by Oklahoma Contracting Company of Dallas.

Williams Brothers Corporation of Tulsa, Oklahoma, has two spreads in the field and is laying the line from Slaughters to the Ohio River near Carrollton, Kentucky, a distance of 160.49 miles. In addition, the contractor is installing the Ohio River crossing under a separate contract.

From the Ohio River on to the terminus near Middletown, Ohio, Midwestern Constructors, Inc., Tulsa, is in charge of construction. This section is 78.60 miles in length.

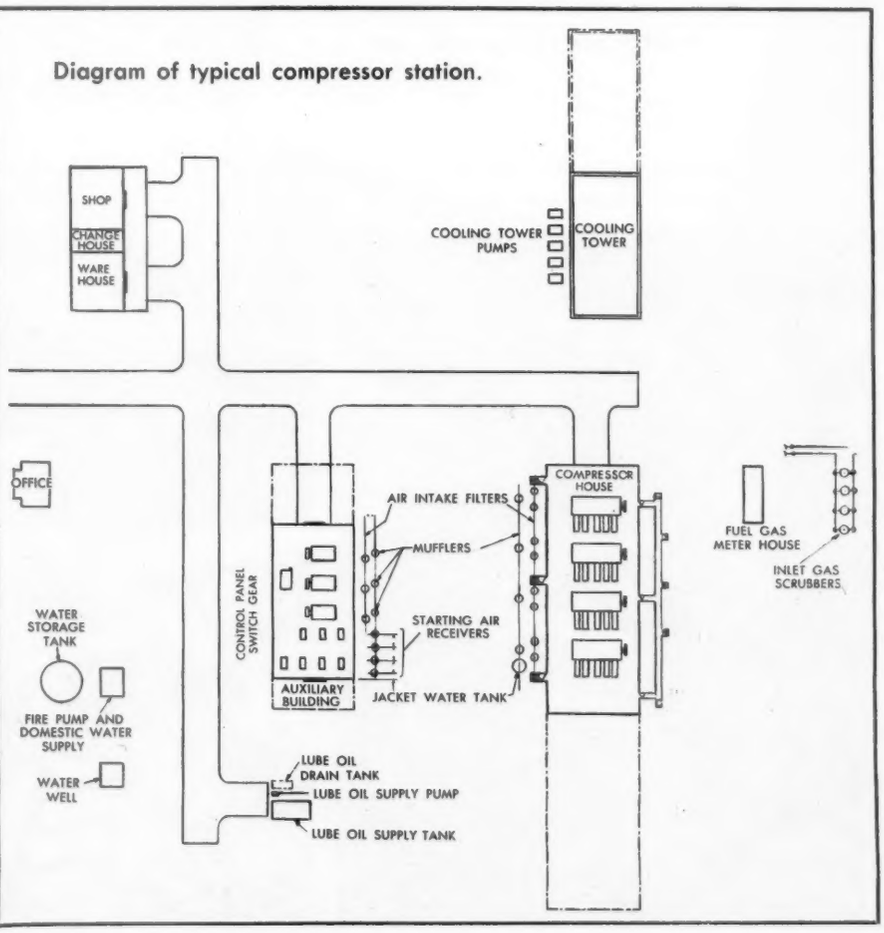
In addition to these main line contracts and the special river crossing mentioned, Omaha Dredge and Dock Company of Omaha, Nebraska, was awarded contracts to install crossings of the Tennessee, Cumberland, and Green rivers.

Terrain

The East Texas and North Louisiana country is rolling though not mountainous. The first half of the succeeding section, between Sharon and the Mississippi, is rolling with the balance in the delta. The latter is flat but the soil consists of heavy gumbo deposits. From the Mississippi River to Lula, Mississippi, the line is entirely through delta country, which provides ideal conditions for pipe

When angledozers get stuck and have to be pulled out you know the right-of-way is really spongy.

Diagram of typical compressor station.



Kapko rock pads protect coating in rocky areas.

line construction except in wet weather. Fortunately, conditions have been favorable thus far with rainfall normal.

The western part of Kentucky, up to the Tennessee and Cumberland rivers, is rolling. The soil texture is light and considerable trouble has been experienced with caving ditch. After the line crosses the two rivers mentioned, however, the soil is mostly of red clay with occasional limestone rock. The latter has required some blasting. The country is rolling and at times the hills become fairly steep.

Between Slaughters and Brandenburg, except for the Green River bottom, the soil is of red clay interspersed with areas of limestone. These areas are numerous and considerable blasting is necessitated. These same conditions prevail also between Brandenburg, Kentucky, and the Ohio River, other than across Jefferson County, Kentucky. As the line approaches the Ohio River the hills become quite steep, although they could not be accurately termed mountains, and there is quite a lot of rock to cope with.

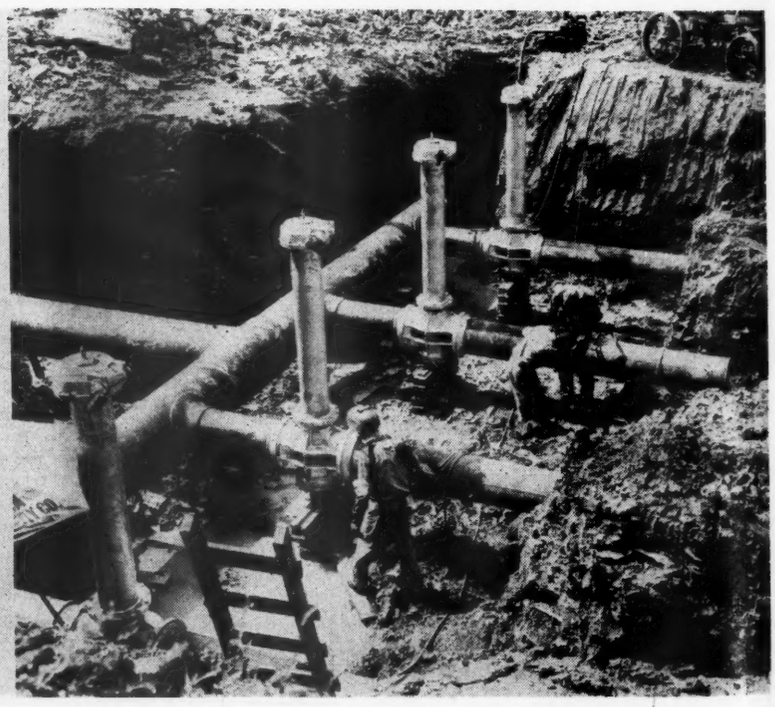
For approximately half of the final spread, from the Ohio River to Middletown, the same kind of terrain exists. The last half, however, is through fertile Ohio farm land, which is mostly level.

Construction Highlights

Longitudinal weld pipe is being used throughout the line. The 26-in. main line pipe has a 9/32-in. wall and

Installing a Griptite anchor in a swampy area.

Fabricating header and installing valves at Ohio River crossing.



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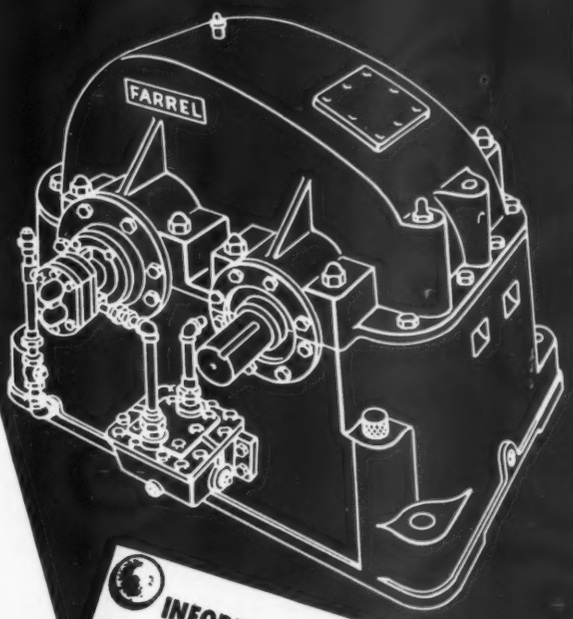
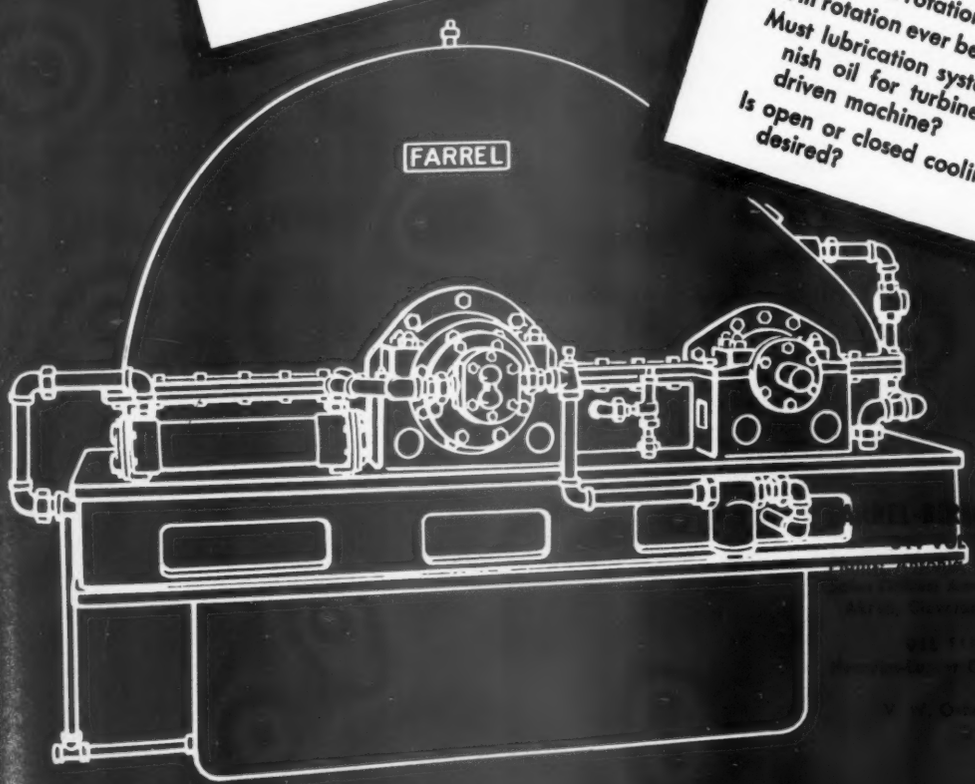
Today, the *modern* line of Farrel speed increasing units consists of 49 standard sizes with speed ratios ranging from 1:1 to 12:1. For higher ratios, units using two sets of gears are supplied with ratio range from 12:1 to 40:1.

For full information about these *designed-for-the-job* speed increasers, write for a FREE copy of NEW Bulletin No. 448.



INFORMATION REQUIRED FOR QUOTING OR ORDERING

Kind of driver?
Kind of driven machine?
HP and RPM of driver?
HP and RPM of driven machine?
Hand of unit?
Are any shafts to be double extended?
Direction of rotation?
Will rotation ever be reversed?
Must lubrication system also furnish oil for turbine, motor or driven machine?
Is open or closed cooling system desired?



Welding pipe into 3-joint lengths at Mississippi River crossing. Joints were reinforced as shown.

weighs 77.25 lb per linear ft. The 20-in. main line pipe has the same wall thickness and weighs 59.23 lb per ft. Railroad, highway, and single stream crossings are being laid of pipe having a ⅜-in. wall. On multiple river crossings pipe having a wall thickness of ½ in. is used. The 26-in., ⅜-in. wall pipe weighs 100.63 lb per ft and the 16-in., ½-in. wall pipe 82.77 lb. The pipe is being made by A. O. Smith Corporation from plate shipped from a Pennsylvania mill. A rigid inspection service is maintained both at the plate mill and pipe mill. This service is provided by an independent engineering organization. Each joint of pipe is tested to a pressure of 1000 psi before being shipped.

Another point that is being stressed is the quality of welds. The men who make the rigid inspection for the company are all qualified welders themselves and thus know their business. Each is provided with a pulling machine to pull coupons on the job when qualifying welders and also to test welds periodically as the construction work progresses. Tensile, bend, and nick tests can thus be made in the field. In addition, extensive use is being made of X-ray. Every weld on river crossings is tested by X-raying, and on the main line spot checking is done by this means.

Due to the great buoyancy of the 26-in. pipe, liberal use is being made of Griptite anchors and precast concrete anchors. In swampy areas that cannot be dewatered the anchors are used to assure the pipe of remaining buried until such time as the backfill has settled and vegetation grown over the right-of-way.

As considerable rock is found throughout the 833-mile length of the pipe line, Kapko rock shields are being used to protect coating in such areas. The shield is wrapped around and strapped to the pipe before it is lowered into the ditch. This eliminates or reduces the need for padding the ditch with dirt.

Cathodic protection will be installed along the system immediately, power to be provided by rectifiers.

A far-sighted policy and one for which Texas Gas should be commended is the manner in which steps are being taken immediately to restore the right-of-way to its original condition. Soil technologists are employed to work with farmers and soil conservation officers while construc-

Left, lowering-in pipe immediately behind the coating and wrapping machine and, right, making a smooth bend.

Two More Saigh Jobs Under Way!

N. A. Saigh Company, Inc., is now laying four 16" lines across the Mississippi river near Greenville, Mississippi . . . and 103 miles of 20" gas line from Carthage, Texas, to Sharon, Louisiana.

Both of these jobs are for the Texas Gas Transmission Corporation.

N. A. SAIGH COMPANY, INC.

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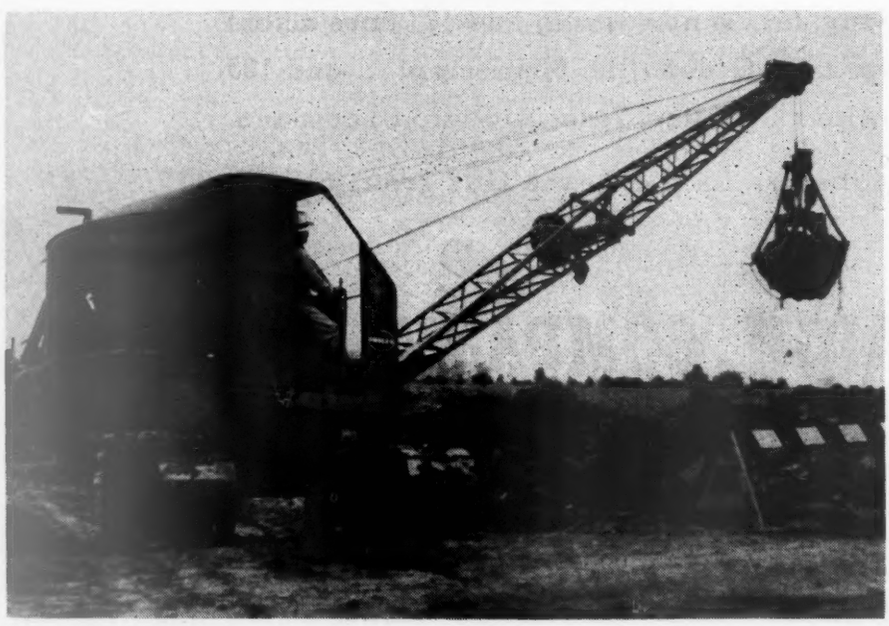
Pipe Line Engineers and Contractors for 28 Years

Cleaning and priming pipe prior to coating and wrapping.

tion work is in progress. After the proper type of vegetation to plant is determined the right-of-way and backfill are cultivated, fertilized, and seeded. At the same time diversion ditches are dug and terraces made. This is a job that has to be done later anyway and by performing it as the work progresses goodwill is created on the part of the property owner and the total cost of the work is less than it would be if postponed until later, particularly when considering the maintenance work that must be done in the meantime.

On the Texas Gas system there are three supervisors, J. W. Carneal, who is in charge of the work, and M. E. Bless and Aaron Griffith, who act as his assistants. The crews working under these supervisors are company maintenance men. Twelve Ford tractors, tilt-type trailers, and garden tools constitute the equipment with which these men work.

Clamming out ditch at a road crossing.

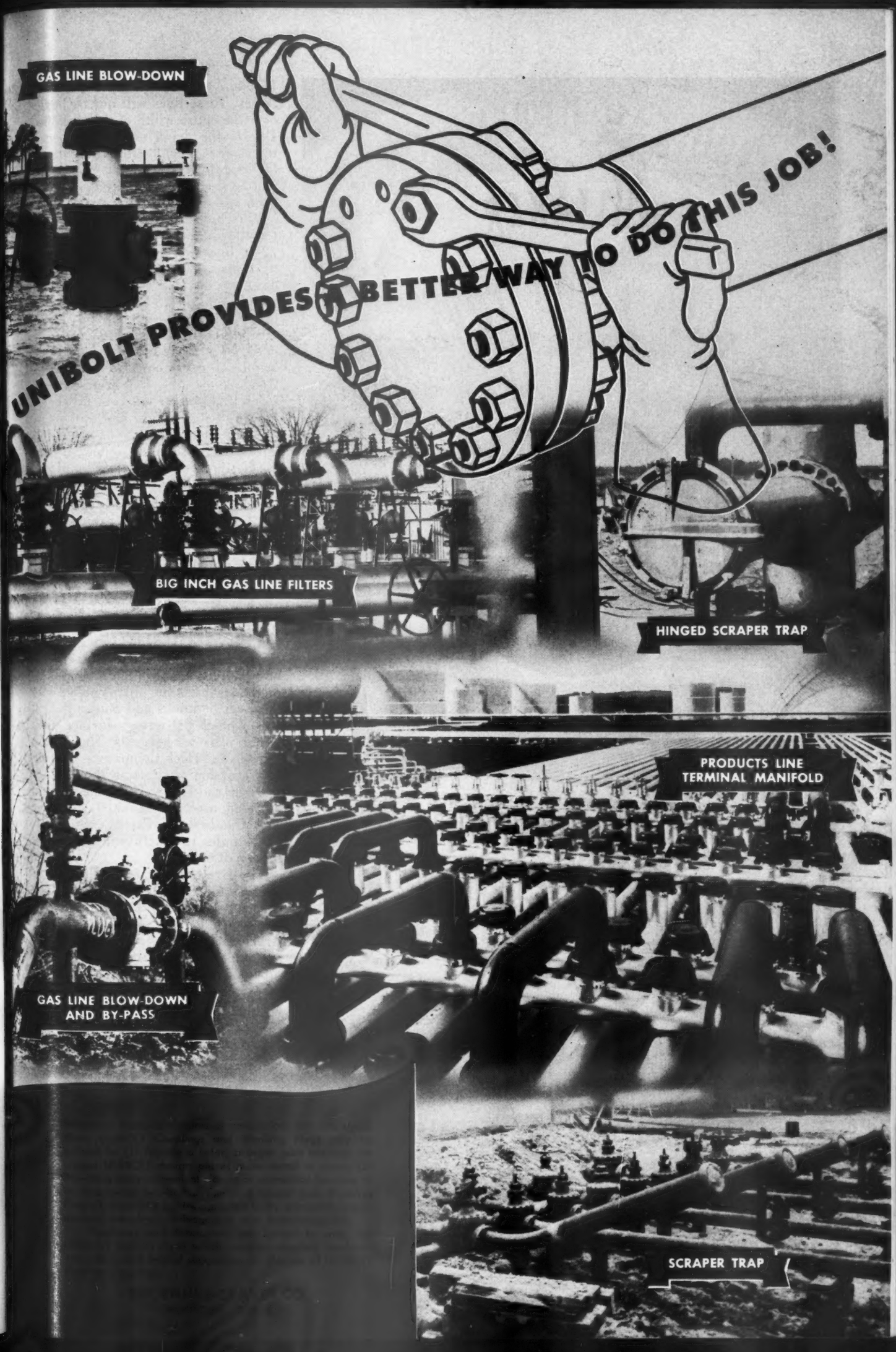


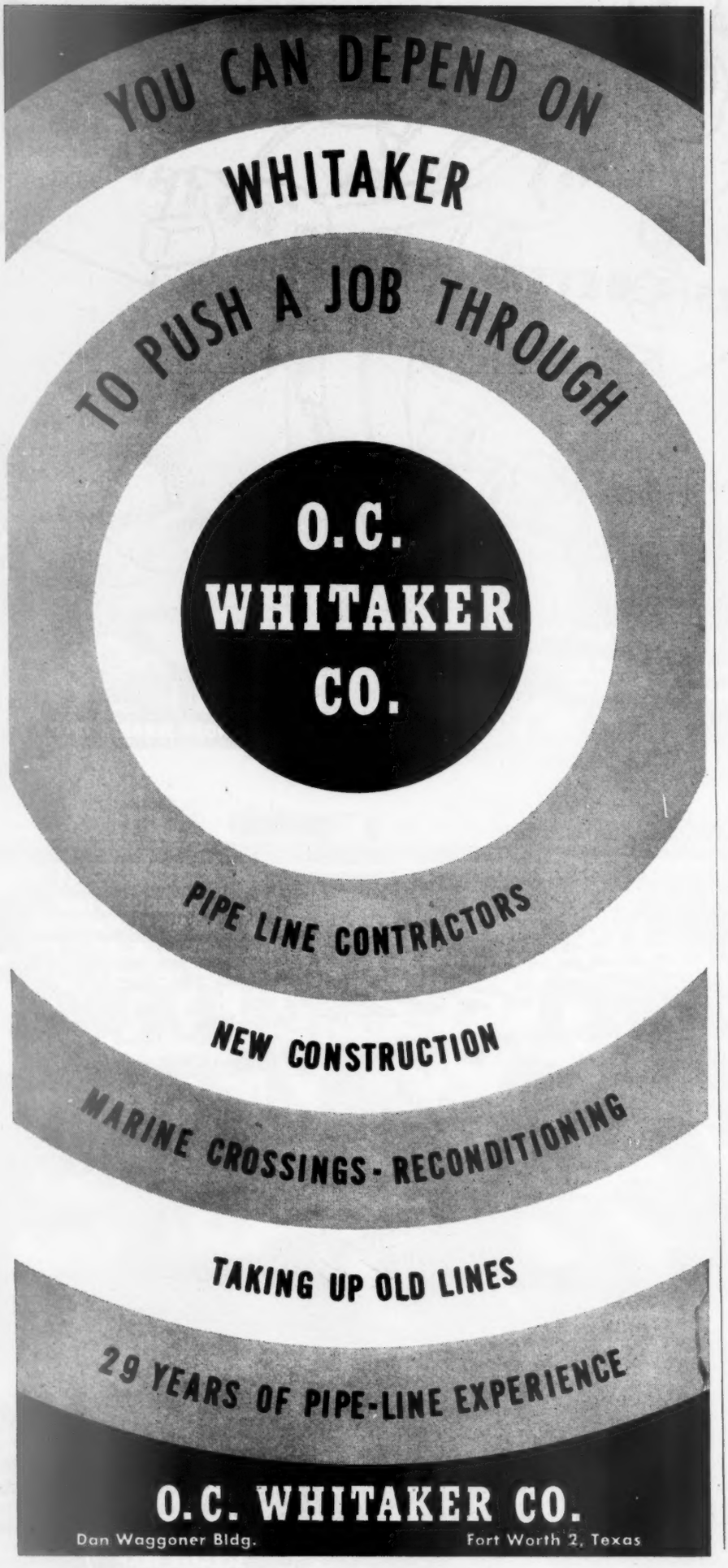
Major River Crossings

A great many small rivers, creeks, bayous, etc., are crossed by the course of the line, all of which are being installed by the contractor laying the section of main line where they occur. Six special river crossing contracts were let, however. These were for the Red, Mississippi, Tennessee, Cumberland, Green, and Ohio rivers.

The distance from header to header of the Red River crossing will be 1.837 miles. Two 16-in. lines will be laid by the pull method. The principal problem here will be excavating to the proper depth. The pipe will be buried 5 ft below the bed of the river and this level will be carried back into the approaches approximately 1000 ft on each side of the river. The river bottom will be dredged. The pipe will be of ½-in. wall thickness and cast-iron river clamps weighing 3300 lb each will be installed over each joint, thus giving 40-ft spacing. Work has not yet begun on this crossing.

The Mississippi River is being crossed at a point near Greenville, Mississippi. Four 16-in. lines are being installed by the N. A. Saigh Company. The pipe, of ½-in. wall thickness, is being welded into three-joint sections for laying from a barge. The length of this crossing is 2.246 miles including approaches, the water distance being approximately 4000 ft.


GAS LINE BLOW-DOWN
UNIBOLT PROVIDES A BETTER WAY TO DO THIS JOB!
BIG INCH GAS LINE FILTERS
HINGED SCRAPER TRAP
PRODUCTS LINE TERMINAL MANIFOLD
GAS LINE BLOW-DOWN AND BY-PASS
SCRAPER TRAP



Headers will be placed outside the levees. These lines will not be buried over the entire width of the river bed. Due to the depth and turbulence of the river it is impossible to dredge in the middle, consequently the stream will be dredged for approximately 90 ft on one side and 300 ft on the other.

The diameter of the pipe is larger for the Tennessee River, where two 22-in. lines are being installed. Specifications called for 20-in. pipe on this crossing, as well as the Cumberland and Green, but 22-in. was substituted because it was impossible to get immediate delivery on ½-in. wall pipe in the 20-in. Including approaches, the length of the Tennessee crossing is 2.632 miles, the wet section being 1150 ft. Concrete weights are being used as river clamps, and are spaced on 7-ft centers. This also is a pull job, but methods used vary somewhat from the customary. Small gauge railroad tracks have been installed from the

☆ ☆ ☆

Pictures of some of the men connected with construction of the pipe line appear on pages D-50 and D-51.

☆ ☆ ☆

water's edge back several hundred feet. The pipe is welded into long sections, the concrete clamps installed, and the pipe strings placed on dollies on the track. As the pipe is pulled into the river pontoons and barges float it just beneath the water's surface until it is in place for lowering. The Omaha Dredge and Dock Company is making this crossing as well as that of the Cumberland River. The same method is being used in the latter instance. The Cumberland River crossing is 1.324 miles in length and has a wet section of 650 ft.

The Green River is 0.898 mile in length with the wet section 300 ft. This consists of two 22-in. lines and is being installed by Midwestern Constructors, Inc. The pipe is being buried to a depth of approximately 5 ft. The pipe is welded on shore and carried to the water's edge by side-boom tractors and pulled into place.

Four 16-in. lines are being laid across Ohio River by Williams Brothers Corporation, also a pull job. This is the widest body of water being crossed, the wet section being 2400 ft. The entire crossing, however, including approaches is only 0.852 mile. Cast-iron river clamps are used.

Several other sizeable rivers are being crossed, the crossings being made by the mainline contractor. Among these are the Sabine with a 200-ft wet section; the Ouachita with a 375-ft wet section; Salt with a 175-ft

The "stove-pipe" method of construction was used on the line. Here with sideboom tractor a joint of pipe is being lined up for the tack weld. Close behind finish-welders will complete the work. Including the stringer bead, four passes were made.

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On your trenching jobs CLEVELANDS give you the Stamina, Speed, Maneuverability and Power to meet with ease and sureness the toughest conditions of soil and terrain. All-welded construction from the tougher, finer quality materials assures desired strength and ruggedness. A wide range of transmission-controlled speed combinations places always instantly within the operator's reach the best, safest and fastest speed for the work at hand. Extreme compactness, absence of excess weight, fine balance, wide crawlers and unimpaired visibility make for ease of handling in the open or in the tightest places. These are but a few of the many reasons why on your oil field projects—long lines or short lines, big "ditch" or small "ditch"—CLEVELANDS have proved they do more...for less.

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THE CLEVELAND TRENCHER CO.

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Tennessee River crossing showing track upon which pipe was rolled into water supported by dollies.

Stringing pipe along right-of-way in Indiana.

Two types of ditching machines that were used in constructing the line.

Making shot holes for blasting in limestone area.

wet section; the White with a 67-ft wet section, and the Miami with a 321-ft wet section.

All river pipe is being coated with coal tar enamel to an average thickness of 3/32 in. and wrapped.

Compressor Stations

The system when complete will have a total of ten compressor stations, six of which will be constructed this year and upon which work is now under way.

The other four will be built in 1950.

When all ten stations are in operation the ultimate capacity of 400,000,000 cu ft will have been attained.

Two 1000-hp compressor units were installed at Sharon, Louisiana, last year to operate on the 63-mile section of line laid at that time to increase gas volume into Memphis. This year six 1100-hp angle type units are being added.

This station will receive gas from three sources: Texas Gas Transmission Corporation's own 20-in. line from the Carthage field, the Texas Eastern Transmission Corporation's 20-in. line from Beaumont, and an existing 20-in. line from the Lisbon field that has been a part of the Memphis Natural system. Suction pressure from the Carthage line will be at 525 psi from the Texas Eastern line at 610 psi, and from the Lisbon line at 520 psi. Three suction headers thus will be required to bring in gas at these three different pressures. The first five units in the station will be tied to all suction headers, the rest alternated. Maximum discharge into the line will be at 810 psi, assuming an 820 psi discharge at the compressors and a 10 psi pressure loss in the compressor discharge piping. The units will operate single stage. There are 10 power

X-ray Inspection

EMPLOYED ON 4000 MILES OF PIPELINE IN THE LAST TWO YEARS

We want to thank all pipeliners for their acceptance of our modern method of weld inspection and control. The encouragement and cooperation we have received could come only from a wide-awake, progressive industry.

100% X-Ray of Texas Gas Transmission Corporation's Mississippi River Crossing.

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Obtain assurance of good welding workmanship by using X-Ray.

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Welding scene on 26-inch gas line being laid in North Louisiana.

LATEX CONSTRUCTION COMPANY

General Contractors

OIL — GAS — GASOLINE — WATER PIPE LINES

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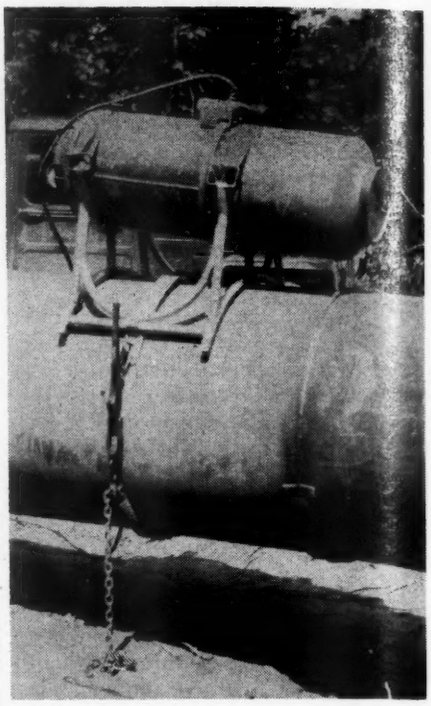
cylinders in the 1100-hp units, which have a 15¼-in. bore and 18-in. stroke. The compressor cylinders, three per unit, have a 9½-in. bore and 14-in. stroke. The two 1000-hp units already installed have the same number and size power and compressor cylinders. The compression ratio is approximately 1.5. Maximum volume pumped by this station will be 425,000,000 cu ft a day.

At Greenville, Mississippi, four 2200-hp angle units are being installed. The ten power cylinders per unit are 17-in. by 17-in. and the five compressor cylinders 10¼-in. by 17-in. Ultimate conditions will be 560 psi suction pressure and 820 psi maximum discharge at the compressors and 810 psi into the line. Maximum volume pumped by the Greenville station will be 409,000,000 cu ft a day, with the compression ratio 1.45.

At Lake Cormorant, Mississippi, four 1920-hp angle compressors will be installed. Each unit has eight power cylinders, with an 18-in. bore and 20-in. stroke, and two compressor cylinders that have a 14-in. bore and 20-in. stroke. This station will have a volume of 405,000,000 cu ft a day at a suction pressure of 575 psi and discharge of 820 psi. The compression ratio will be 1.42.



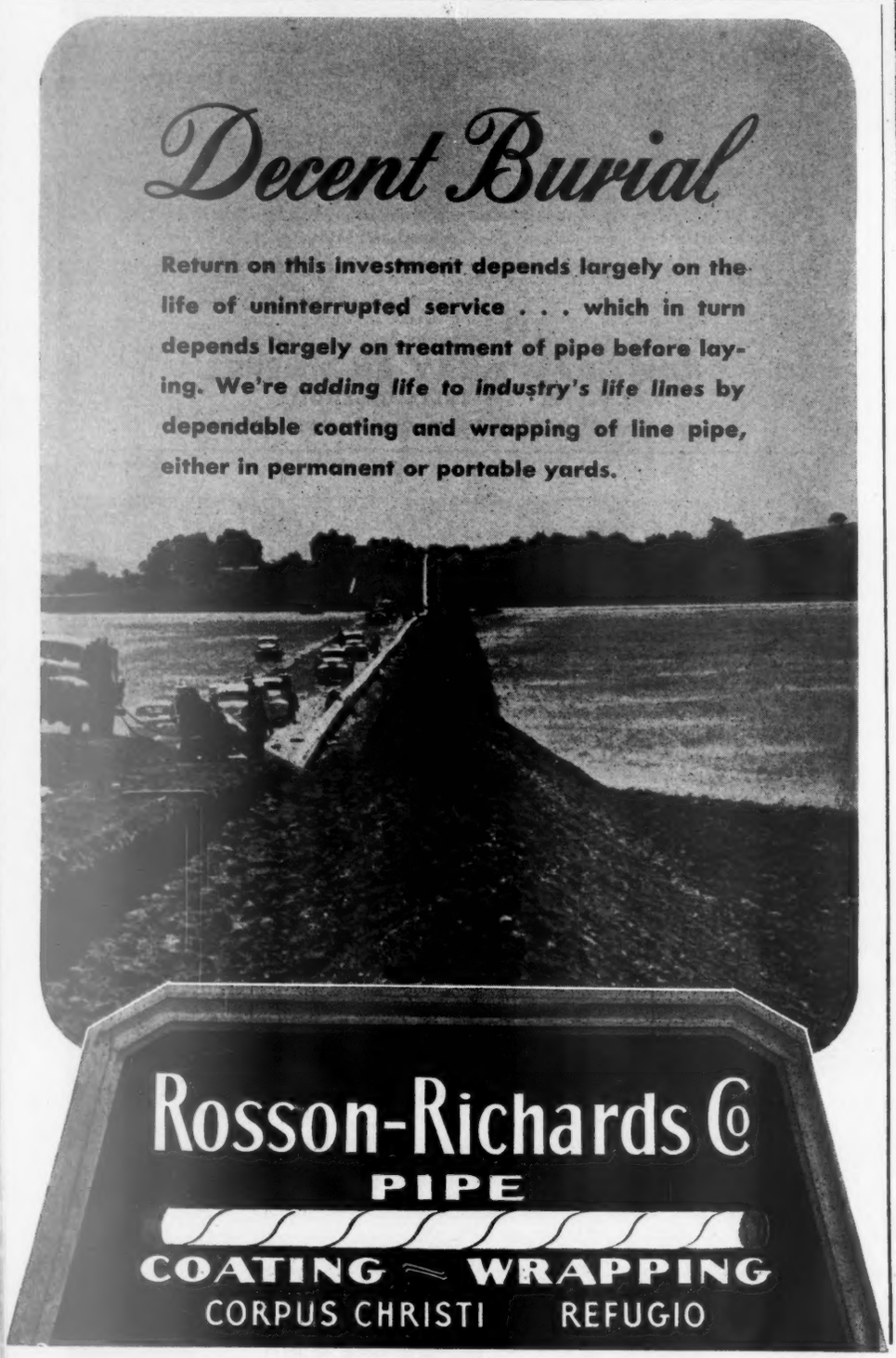
Checking weld with an X-ray machine.

The Kenton, Tennessee, station will have four 1320-hp angle type compressor units. These will have 12 15¼-in. by 18-in. power cylinders per unit and three 11-in. by 14-in. compressor cylinders. Design is for operation at a suction pressure of 450 psi and discharge of 820 psi. Compression ratio will be 1.26. Under these operating conditions the volume of gas will be 335,000,000 cu ft a day.

The station at Slaughters, Kentucky, will be identical with Kenton insofar as the type and number of compressor units are concerned. Design is for a suction pressure of 645 psi and discharge pressure of 820 psi, pumping 289,000,000 cu ft of gas a day. Compression ratio will be approximately the same as at Kenton.

At Louisville, Kentucky, four 1440-hp units having six 18-in. by 20-in. power cylinders and two 13-in. by 20-in. compressor cylinders are being provided. At a suction pressure of 554 psi and discharge of 741 psi the volume of gas pumped will be 248,000,000 cu ft a day. Compression ratio will be 1.33.

Next year four more stations will be constructed. At Bastrop, Louisiana, 8800 compressor hp will be installed to pump 423,000,000 cu ft of gas a day, operating at a suction pressure of 565 psi and a discharge pressure of 820 psi. At Clarksdale, Mississippi, the same number of


Decent Burial
Return on this investment depends largely on the life of uninterrupted service . . . which in turn depends largely on treatment of pipe before laying. We're adding life to industry's life lines by dependable coating and wrapping of line pipe, either in permanent or portable yards.
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PIPE
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horsepower will be installed. Operation will be at 576 psi suction pressure and 820 psi discharge, pumping 407,000,000 cu ft a day. The Covington, Tennessee, station will have 5280 compressor hp to pump 339,000,000 cu ft of gas a day at a suction of 616 psi and discharge of 820 psi. At Paducah, Kentucky, 4320 compressor hp will be installed to handle 330,000,000 cu ft a day. Suction pressure will be 645 psi and discharge 820 psi.

The stations being constructed this year are to be ready for operation by December 1.

Each station will generate its own electricity requirements. For this purpose the following units will be provided:

Sharon, Louisiana, four 190-kw generators driven by four 275-hp gas engines.

At Greenville, Mississippi, three 280-kw generators driven by 406-hp gas engines.

Lake Cormorant, Mississippi, three 210-kw generators driven by 300-hp engines.

Kenton, Tennessee, two 280-kw generators driven by 406-hp engines.

Slaughters, Kentucky, two 280-kw generators driven by 400-hp engines.

Louisville, Kentucky, two 280-kw generators driven by 406-hp gas engines.

Stone and Webster Engineering Corporation is doing the engineering and construction of the stations. J. Ray Fisher, superintendent of compressor stations for Texas Gas Transmission Corporation, is supervising station construction for the company, assisted by J. B. Eaton, superintendent of compressor stations for the Southern Division. H. L. Stowers, chief engineer for Texas Gas, has the overall supervision of design and construction.

Gas Storage Fields

An ambitious program has been embarked upon to provide underground storage facilities from which gas can be withdrawn on days of peak demand. Ultimate use of seven underground storage fields having a total capacity of 21,500,000,000 (billion) cu ft and a maximum daily deliverability from storage of 77,000,000 cu ft, has been announced by L. E. Ingham, vice president.

The only underground storage reservoir presently in operation is the Oaktown storage field near Oaktown, Indiana. This field is the company's initial experiment in the storage of gas underground. It has a capacity of 1,000,000,000 (billion) cu ft and a maximum deliverability of 6,000,000 cu ft a day. Underground storage has two benefits: (1) To take care of demand during severely cold weather, and (2) Permit main lines to operate at or near full capacity during summer months.

Texas Gas Officers

Officers and operating heads of Texas Gas Transmission Corporation consist of the following:

J. H. Hillman, Jr., president; W. T. Stevenson, executive vice president; L. E. Ingham, vice president in charge of operations; A. L. Roberts, general superintendent; H. L. Stowers, chief engineer; T. W. Kirkpatrick, secretary; J. W. Polkinghorn, assistant secretary and head of the land department; W. M. Elmer, treasurer and head of the accounting section; H. F. Keith, assistant treasurer in charge of purchases; H. L. Mann, vice president in charge of gas procurment division; D. C. Benson, superintendent of measurements; W. A. Johnson, superintendent of pipe lines; J. Ray Fisher, superintendent of compressor stations; F. D. Stull, superintendent of communications and cathodic protection; P. L. Frey, construction supervisor; and R. L. Anderson, construction supervisor. * * *

PARKHILL AT WORK

on the Texas Gas Trans. Corp. Line

ROY F. PARKHILL TRAP BRISCOE

PARKHILL TRUCK COMPANY, INC.

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Some of the thirty-six 93,000-bbl tanks in the Tripoli tank farm with the 5000 bbl a day refinery in the foreground. Construction work now in hand will double the capacity of the refinery.

P 615.3

IPC Increases Pipe Line Throughput

ADEQUATE reserves of oil had been proved at Kirkuk by 1931 to justify the construction of a pipe line system to the Mediterranean Seaboard and the necessary transit arrangements were made with the governments of Palestine, Transjordan, Syria, and Lebanon to enable work to proceed. The two 12-in. lines projected ran parallel from Kirkuk to the Euphrates and thence bifurcated, one traversing Transjordan and Palestine to the Bay of Acre (north of Haifa) and the northern line traversing Syria and Lebanon to Tripoli.

EDITORS NOTE: *This article was prepared by the staff of the Iraq Petroleum Company, Ltd.*

Final surveys of the alignments were completed in 1931 and in the first half of 1932 water wells were drilled; railhead depots constructed at Tripoli, Homs, Mafraq, Baiji, and Haditha, and the organization of the transport system completed. Actual construction of the 12-in. lines began in August, 1932, with a labor force of 4878 local employes and 182 foreign staff.

Construction of the north line to Tripoli was completed in July, 1934, and the first oil reached Tripoli on July 14. The southern line was completed in October, 1934, and oil was first delivered to the Haifa terminal on October 14, exactly seven years after oil was first struck at Kirkuk.

The northern line is 532 miles long and the southern 620 miles. Each line has a capacity of 2,000,000 tons of crude per annum (42,500 bbl a day). They were the first all-welded pipe lines to be built outside the United States.

Three pump stations—K.1, K.2, and K.3—situated respectively 5 miles west of Kirkuk oilfield, 10 miles west of the Tigris, and 1½ miles west of the Euphrates, serve both lines to the point of bifurcation. Beyond this point

there are four pump stations on the northern line and five stations on the southern line.

The pump stations were equipped with 6¾-in. by 24-in. horizontal duplex double-acting Worthington-Simpson pumps, working at 800 psi and directly connected to 500-hp diesel engines. There were six units at each of the three stations serving the double line to the point of bifurcation at K.3 and three units at each of the single line stations west of that point.

All the engines burn crude oil taken direct from the pipe line and pumps and engines are everywhere separated by gas-tight fire walls. Auxiliary equipment includes 8-in. by 10-in. piston-type suction pumps for emptying sections of the line in case of necessity, and 4-in. by 6-in. piston-type sump pumps for handling drainage oil.

The pump stations not only supply the power necessary to sustain the flow of oil at the designed throughput and act as control points for checking the quantities passing through the line, but also act as bases for line repair and maintenance. They are in fact miniature towns in artificial oases. Situated as they are in a desert inhabited only by nomadic tribesmen every need of the maintenance staff has to be provided by the company. At each station there were one or more houses with four main rooms for senior personnel; six houses with three main rooms for married engineers, and a mess block with servants' quarters, flanked on one side by a block of bachelor quarters and on the other side by a block of quarters for transients.

In the design of the quarters every effort is made to ameliorate the discomforts of extreme heat and cold and to exclude disease-carrying insects. In summer, shade temperatures of 120 F are common and mid-day temperatures of 110 F recur for weeks on end. In winter the temperature falls far below freezing. There is no natural shelter against the strong winds that sweep across the desert for a great part of the year and which in summer frequently become dust-storms, greatly increasing the discomfort of desert life. As a protection from heat, roofs are made as thick as the walls, and consist of earth carried by steel troughs. Rooms all face north and south thus excluding direct sunlight in the summer and permitting it in winter. Rooms are high and provided with cross-ventilation, and south windows are protected by verandas. Against the cold of winter, central heating is provided. All windows and doors are fly-proofed and the number of outside doors reduced to a minimum.

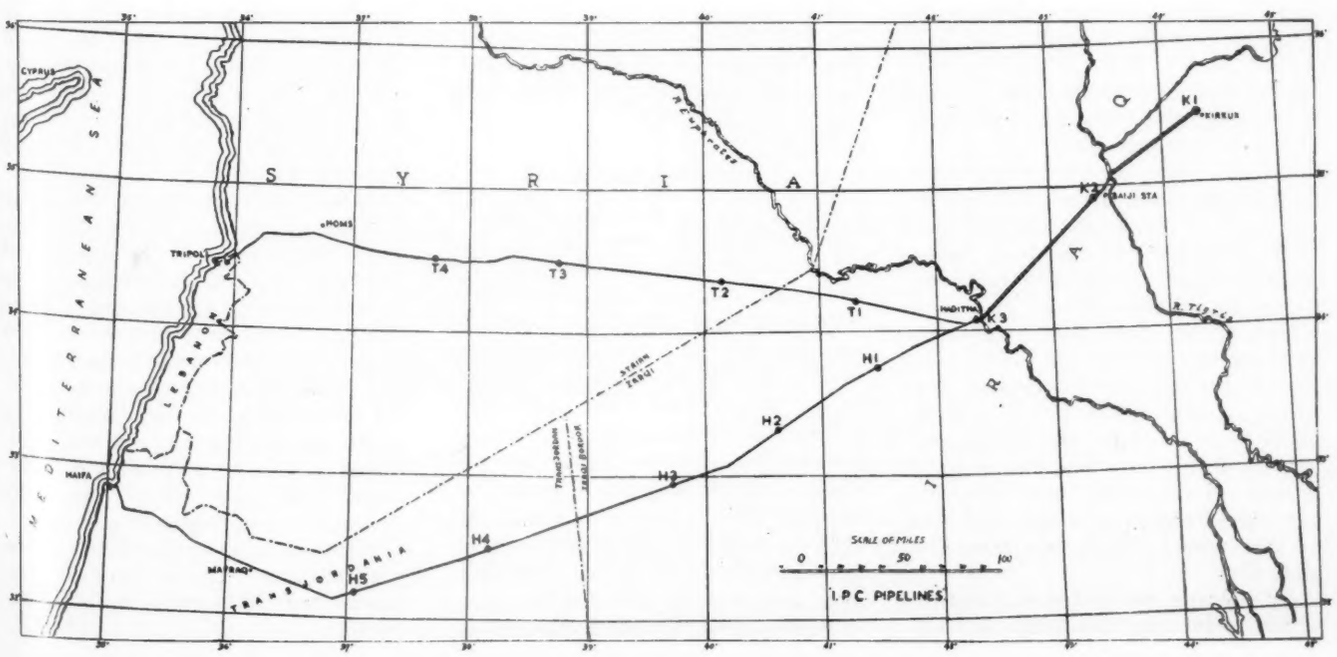
In addition to the housing, each station is provided with a service unit to accommodate departmental offices and stores and to act as a defense post in the event of disturbance. It is equipped with two-story bastions at two corners and contains both high-level and low-level water storage. Apart from tankage and garage accommodation the service units contain 26 rooms including laundry, bakery, food store, canteen, cold storage, ice and soda plants, dispensary and sick rooms, and wireless equipment.

As some indication of the magnitude of the task of constructing the pipe lines and transporting the necessary materials and equipment the following figures are of interest:

Between August, 1932, and May, 1934, 96,500 tons of cargo were landed at Basrah and forwarded to the Iraqi railheads of Baiji and Haditha; 54,000 tons were landed at Tripoli and forwarded to the railhead at Homs, and 57,000 tons at Haifa and transported by rail to Mafraq or intermediate points. The total overseas tonnage of materials was thus 207,500 involving some 37,000,000 ton-miles of rail transport in the Middle East. Local materials brought the total tonnage of materials and equipment handled up to 430,000 tons, made up as follows: Stone, sand, and gravel, 47 per cent; pipe, 29 per cent; engineering and station materials, 13 per cent; petrol and water, 8 per cent; pipe protection materials, 2 per cent; and transport stores, 1 per cent. The motor vechicle ton-mileage involved in transporting these materials exceeded 23,000,000 ton-miles.

The terminals at Tripoli and Haifa respectively were provided with 36 and 27 tanks, each of 93,000 bbl capacity. At Haifa there are an oil dock with four berths each capable of loading at rates of from 600 to 700 tons per hr and four 12-in. sea lines, whereas at Tripoli there were three 12-in. sea lines to each of three berths situated 4420, 4400, and 4470 ft from the shore.

Iraq Petroleum Company pipe lines in the Middle East



New Construction

Prewar plans for increasing the capacity of the pipe line system were delayed by the war and it was not until October, 1946, that construction began of new 16-in. lines, each of 90,000 bbl per day capacity, paralleling the original 12-in. lines.

The original plan was first to complete the 620-mile Kirkuk-Haifa line and thereafter to build the 532-mile line to Tripoli. Laying of the Haifa line was completed to within 50 miles of the Haifa terminal by the spring of 1948 when the disturbed conditions in Palestine caused the suspension of operations on this line. Labor and materials were then transferred to the north line where facilities were concentrated on the completion of the 383-mile sector between K.3 and Tripoli. Stringing began in May, 1948, and was completed a year later; ditching began in August, 1948, and was completed in June 1949, and welding began in October, 1948, and was completed in July, 1949. The total tonnage of 16-in. pipe laid in this sector was 60,000 involving 6,287,000 ton-miles of transportation. Ditching was carried out by The Contracting and Trading Company on a contract basis. In eastern and central Syria some 330 miles of the ditch was mechanically excavated using Allan Parsons ditching machines and Ruston Bucyrus RB19 excavators with "back acter" equipment.

In the lava and limestone country of western Syria and the Lebanon, blasting was necessary for an aggregate distance of some 50 miles.

The welding was done by truck-mounted portable welding sets supplied from the U. K. by Murex Welding Processes, Ltd., or from the U. S. A. by Lincoln Electric Company, using Murex or Lincoln welding rods. The total number of welds in the K.3-Tripoli sector of the 16-in. line was 60,341, including: 16-in. pipe 57,383; tie-in manifolds 640; and road, rail, and river crossings, 2318.

After welding the pipe was primed with Wailes Dove primer, followed by one coat of bitumastic enamel, specially developed by the Iraq Petroleum Company, Ltd., and manufactured by Wailes Dove. A spiral wrapping of glass fiber was then mechanically pulled so as to sink into the hot coating which is applied at a temperature of 350 to 400 F. A wrap of Rukene (a bitumen-impregnated asbestos-felt) was then pulled by a second spindle of the same machine over the saturated glass fiber and held by the enamel, which penetrated the glass fiber.

By utilizing the Kirkuk-K.3 section of the 16-in. line, originally laid for the south line, and using standby and temporary pumping sets, it was possible to begin pumping through the 16-in. line to Tripoli in July, 1949, and this line is expected to be operating at its full capacity of 90,000 bbl a day in 1950.

Completing the last weld on the 16-in. line to Tripoli

Due to the disturbed conditions that followed the British surrender of the Palestine Mandate, and more recently the objections of the Iraq Government to the export of crude to Israel, the Kirkuk-Haifa 12-in. line has been shut down since July, 1948. When it is again possible to operate this line and to complete the remaining 40 miles of the Kirkuk-Haifa 16-in. line, the combined capacity of the Kirkuk-Mediterranean system will be 270,000 bbl a day.

Enlarging Stations

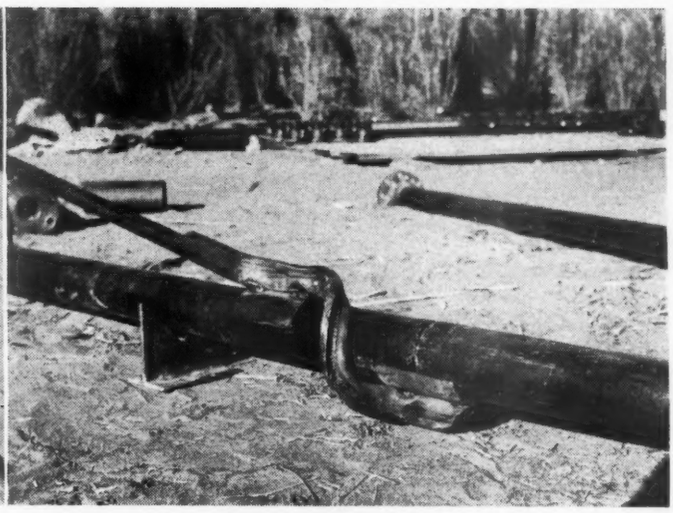
To provide for this throughput the pump stations between Kirkuk and the point of bifurcation west of K.3 are being enlarged and re-equipped with centrifugal pumps. Each of these stations will have six motor-driven Mather and Platt centrifugal pumps each of 156,000 bbl a day capacity at 500 psi to be operated in pairs, in series. Two pairs will give the designed capacity with the third pair as standby. Each pump is driven by an 1800-hp motor supplied with current by its own diesel-driven 1560-kva alternator (except at K.1 where current is supplied from the Fields' power station). The alternators, which are by the English Electric Company, are powered by Crossley-Premier 16-cylinder horizontally opposed diesels of 2000 hp.

Beyond the point of bifurcation the pump stations on the north and south lines will each be equipped with four reciprocating pumps, each of 50,000 bbl a day capacity at 1000 psi. The pumps, which are manufactured by Worthington-Simpson, Ltd., are horizontal reciprocating units of the triplex double-acting type, with outside-packed opposed plungers of 7¾-in. diam, with a stroke of 24 in. The prime movers are Harland and Wolff airless injection oil engines, developing 950 bhp at 300 rpm, coupled to the pump through a flexible coupling and intermediate shaft passing through the fire wall.

In addition to the laying of the pipe and the enlargement of the pump stations, the increase in the capacity of the system has involved a heavy construction program, including the provision of additional tankage at each pump station and at the Tripoli terminal where the loading capacity is being increased by the installation of an additional loading line; and the building of houses for artisans and supervisory staff, and schools for their children, at each station.

The peak labor requirements of the program were 11,750 company employes and 3800 employed by contractors. ***

Closeup showing construction of "grasshopper."



(Photos courtesy The Lincoln Electric Company)

Equipment is in place with pipe joints lined up.

"Grasshopper" for Pipe Line Welding

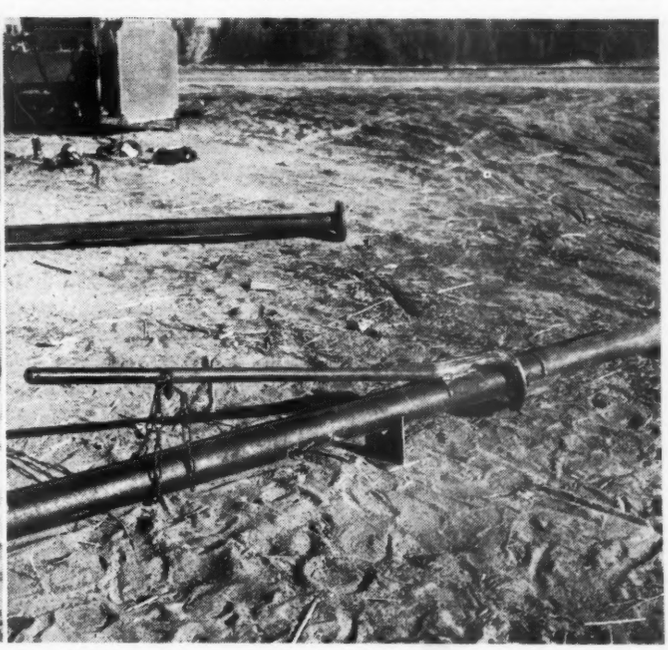
A west coast welder built the unusual instrument shown in the accompanying photographs to facilitate the lining up of pipe previous to welding. In use the "grasshopper" is placed on the pipe line by the welder, leaving the lower shoe of the instrument about 2 in. beyond the end of the section to be welded. By means of a short chain on the handle, the instrument can be anchored on the line after another section of pipe has been put in place.

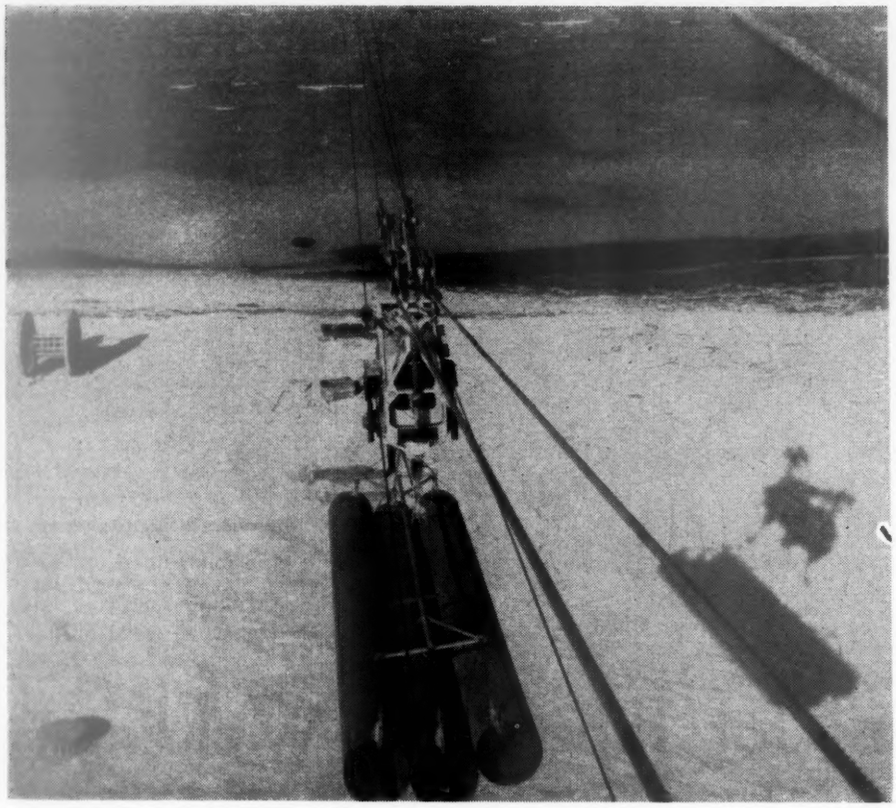
The "hopper" shown here fits a 3-in. line; however, any size may be built. In constructiong the one shown, a 4-ft piece of 1-in. pipe was welded to the bottom of a short length of 3-in. pipe, and while applying heat to the 1-in. pipe it was slowly bent around the larger pipe forming a figure "S." On reaching the top side of the larger pipe, the smaller pipe was welded in place. The 3-in. pipe was then cut in half and trimmed down to make "half-pipe" shoes about 5-in. long at the welded joints. A ½-in. rod was welded in place along the curved pipe for added strength. The short chain length was welded to the handle about 1 ft from the end. The loose end of the chain after passing around the pipe line is fastened to a hook welded to the handle.

* * *

Chain welded to handle serves to anchor instrument to pipe.

Chain is passed around pipe and fastened to hook on handle.





Riding on cables through the air for three miles over the Persian Gulf at Ras el Mishaab, Saudi Arabia, this man-operated skyhook carries tons of steel pipe from vessel to supply base. Operator communicates with shore office by means of two-way radio.

Trans-Arabian Line Poses Interesting Design Problems

RICHARD SNEDDON*

In a recent series of addresses, S. P. Johnson, Standard Oil Company of California engineer, has made some interesting observations on the design and construction of the Trans-Arabian Pipe Line, of which the following is a somewhat casual abstract: The big project by reason of its remoteness, and the consequent necessity of having a sizable organization to support the construction crews, presented unique transportation problems. At the same time it prompted some innovations in equipment and technique that are worth the attention of engineers and transportation specialists.

In 1943, during the early deliberations, the largest pipe available in the United States was 26 in. diameter. This was made by an electric welding process from steel plate, which at the time was extremely scarce, and it looked as though it might become necessary to resort to the use of 24-in. seamless pipe—the largest of this type then procurable, the same material as that used in the Big Inch. Experience in the latter had indicated that, excepting under unusual circumstances, it was not worthwhile to make corrosion allowances in design calculations on this job, and that a working stress of 65 per cent of the minimum yield point, based on normal wall thickness, was satisfactory. Possible variations in thickness due to corrosion were included, with other thickness variants in the factor of safety, all of which as explained was based on actual experience. Normal crudes rarely corrode pipe, and corrosion from the outside due to soil conditions usually produces perforations too small to have any material effect on the overall strength of the pipe. It was further expected that adequate wrapping and cathodic protection, where the pipe was buried, would prevent serious external corrosion.

The initial capacity, tentatively agreed upon by the design engineers was 300,00 bbl a day, which approximates the optimum for a 24-in. line, and at the same time seemed to be about what the daily production might amount to by the time the line was completed. When the war appeared to be won and the government had lost interest in the construction of the line, the same basic reasons that had prompted federal interest now stimulated and justified a similar desire on the part of private industry. The surveyed distance of the present pipe line route is 1067.5 statute miles, whereas the tanker haul around the Arabian Peninsula and through the Suez Canal to Port Said is 3650 statute miles. To carry 300,000 bbl a day by the sea route would require about 62 T-type tankers, and tankers just weren't to be had. Besides, their construction would have taken more steel than the pipe line. In addition, pipe line steel requires less fabrication than does the same tonnage in ships. As to transportation cost, it was believed that movement by pipe line would be decidedly less than by tanker, and although the differential is not so great today, the cost spread is still strongly in favor of pipe line transportation.

Line Pipe

In late 1945, the 24-in. pipe idea was conceded to be uneconomical for the quantity of oil to be handled, and a thin-walled 30-in. pipe was decided upon. The procurement of the pipe was still a difficult matter, but eventually arrangements were made to have 30 and 31-in. pipe fabricated in Maywood, California, from ¼-in. plate rolled at Geneva, Utah. The steel is medium carbon, medium high manganese, semi-killed material of the following specifications: C—0.30 maximum; Mn — 0.85 to 1.25; P — 0.045 maximum; S—0.05 maximum. In the fabricating process at Maywood, the plate is first planed to exact size, then rolled, and finally welded inside and out by the "Union-Melt" process. After welding, the tubes, slightly undersize, are expanded hydraulically to full dimension. This process stretches the steel beyond the yield point, and the cold work makes an increase in

*Pacific Coast Editor.

EXCLUSIVE

tensile strength of from 12,000 to 20,000 psi, with a coincidental increase axially of about half that much. Specifications call for a circumferential yield strength of 52,000 psi, and an ultimate of 65,000 psi. The cold work also increases the ultimate strength of the metal in the circumferential direction by as much as 3000 to 7000 psi, an effect not generally recognized.

The expanded pipe is tested hydrostatically to 90 per cent of the minimum specified yield strength of 52,000 psi, and failures are rare. But they do occur, and an interesting example of a failure in the field will be discussed later. The manufacture of 30 and 31-in. pipe was ingeniously contrived to save shipping charges by telescoping the two sizes. There was consideration given even to the idea of telescoping three deep, but that presented complications that it was deemed advisable to avoid. The 1-in. differential in inside diameter was sufficient to permit nesting and denesting with comparative ease, but it has since been agreed that an increase in diameter differential of another ½ in. would have avoided some scoring of the pipe.

Design Problems

The design basis for the line permitted a working pressure of approximately 570 psi for 30-in. pipe, having a nominal ¼-in. wall thickness. With a contemplated flow of 300,000 bbl per average day it was calculated that eight or more pumping stations would be required, but by increasing the wall thickness at the high pressure points on the line to a maximum of $\frac{7}{16}$-in., the working pressure could be increased to 885 psi and the number of stations reduced to six. To appreciate the saving that might thus be occasioned, one need merely know how much remoteness alone increases personnel and facility requirement. Although originally designed, as indicated, for six stations, after construction had progressed somewhat it became evident that a larger daily throughput might eventually become necessary. Steel pipe was still scarce, and early this year it was decided to reallocate the 30 and 31-in. pipe and install intermediate pumping stations to bring the total to 12.

The area traversed by the line runs the gamut of shifting sand dunes—as much as 100 ft high; sabkhas, or sand bogs; stable sands, held by small bushes, known as dikaka; gravel plains, rocky plains—with either superficial or buried rock; lava beds; and semi-cultivated land, mostly at the Mediterranean, and much of it in the

SIDNEY P. JOHNSON, above, is the engineer who supplied the information for this article. As an engineer for the Standard Oil Company of California, Johnson has gained a wealth of experience in pipe line and storage system design since he graduated from Stanford University in 1921 and went to work for Standard. During recent years his experience has gained him assignments all over the world with several of California Standard's subsidiaries and affiliates, and with the government during the war when he worked as a designer of fuel storage depots in coastal and war areas. At the present time Johnson is head of Standard's Electric and Mechanical Division, Engineering Department.

form of rocky hills. Where the dunes could not be avoided, the crossing lines were buried in strategic positions or locations to give maximum stability. Across sabkhas, the pipe is held in pressed steel rings, and is supported on steel piles having I-beam caps. On dikaka territory, gravel plains where ditching can be accomplished satisfactorily, and rocky areas where the rock lies deep enough, the line is buried. If the rock is at an approximate depth of 2 ft, the pipe is laid on a well padded support after excavation. This, of course, offers no anchorage, so anchors are placed at the point of directional change — either horizontal or vertical. In terrain where the rocks are close to the surface, it was planned to support the line at intervals of about 66 ft in pressed-steel ring girders on small concrete pads. Incidentally, static bending movements are maximum at the supports but are only moderate at a 66-ft spacing.

With a differential of about 100 F between the estimated high and low temperatures of the line, expansion seemed to pose quite a problem. Careful weighing of all the involved factors indicated that neither expansion joints nor expansion loops were advisable, however. Zig-zagging was also ruled out as it would, in such large, thin-walled pipe, inevitably introduce secondary stresses and mechanical difficulties of a serious nature. The rise above installation temperature was calculated to be about 70 F, and since one degree change in a completely restrained piece of steel results in an axial stress of approximately 190 psi, this would mean a total stress attributable to this cause of 14,000 psi, which was not deemed excessive, especially when it is considered that circumferential tensile stresses were actually more than double this figure. On the basis of these deductions and other related data, the line was simply held rigidly in place, with suitable anchorage at points of directional change.

Besides the temperature effect there is an axial stress, a result of internal fluid pressure, to be taken into consideration. This latter is tension and tends, thus, to offset the compressive stresses caused by temperature rise. Johnson states that the designers discussed the advisability of calculating the effect of combined stresses by the shear method, but the suggestion was abandoned because there did not seem to be any mechanism that might bring about a complete failure in shear in a structure of this kind; nor was there any probability that shear at an angle to the axis, when the pipe was in compression, might cause the failure of either longitudinal or circumferential welds. The most common types of pipe line failure were cited as rupture of the longitudinal weld due to inherent defects, and parting of the line as the result of tension of circumferential welds made in the field.

At the time of these disclosures, the line had shown some vibrations but deflections were minor—on the order of ½-in. No resonance at any wind velocity encountered had been noted. A rather spectacular failure took place in the course of the hydrostatic field test of that part of the line above ground. While the first section was being tested at a pressure of 750 psi, with the stress 84 per cent of the nominal yield point, one of the longitudinal seams opened for a distance of 3 ft, instantly releasing the pressure. This section of line, long and straight, was laid on 2-pile bents, with I-beams under the ring girder supports. For a mile in the area of the break the line moved axially, the movement being as much as 12 in., sufficient, indeed, to cripple pile caps and ring girders at many points. The movement was much

larger on one side than the other, and was away from the break. A satisfactory hypothesis was advanced for the break, but the axial movement away from the point of failure on both sides is still short of complete rationalization.

Pipe Protection

It was proposed to wrap the buried portion of the line and to provide cathodic protection where it seemed warranted. The procedure adopted up to the time that S. P. Johnson engaged in his several discussions involved a heavy coat of asphalt, a wrap of glass fabric, a second coat of asphalt, and a final outside wrap of asbestos fabric. As a further precautionary measure, the bottom of the ditch was covered with a fabric padding to avoid injury to the coating prior to backfilling. This type of protection has been very effective to date. It has been used mostly in the dikaka country, where the sand is stable and has a high electrical resistance. At a depth of 10 to 20 ft in such areas, damp, salty, low resistance soil is found. A single magnesium anode placed in the salty material has in several instances dropped the electrical potential of the pipe more than a volt for 10 or 15 miles. It is realized, of course, that such satisfactory conditions will not always obtain, and that in other sections resort may have to be made to magnesium ribbon, and to anodes in deep wells at the station sites, where ample power is available. Meantime, the wrappings already applied have a high resistance, giving justification for the belief that corrosion of the buried sections can be kept down to negligible proportions.

Pump Stations

The pump stations on the Trans-Arabian line are unusually large, but otherwise are not exactly unique. Taking all the pertinent factors into consideration, the engineers decided against steam power and in favor of internal-combustion engines, except for the No. 1 station at Abqaiq, which is equipped with two 6000-hp steam turbines, direct coupled to two-stage centrifugal pumps, each capable of delivering 340,000 bbl a day against a maximum pressure of 840 psi. High speed pumping of this type requires adequate pressure on the suction—this is supplied by two vertical pumps in the tank field, each able to deliver full line capacity at about 75 psi. Equipment also includes automatic flow and pressure controls, a recording flow meter for the main stream, and remote reading tank gauges. Precision gauging of oil for royalty purposes in this area is accomplished by balancing the oil column against a mercury manometer—a method that offers a high degree of accuracy.

Although of conventional design, it is of interest that the pumps at Station No. 1 are probably the largest of their type ever built. They operate at 3600 rpm at an 87 per cent efficiency. To obviate packing difficulties imposed by the large shaft, high peripheral velocities, and comparatively high pressures, packing is eliminated entirely, and labyrinth bushings have been installed. These are successively bled to lower pressures and finally to a sump, whence the leakage is returned to the line. Other stations will have single-stage centrifugal pumps—five in each series—driven by 1700-hp diesels through speed-up gears. Pumps operate at 2200 rpm and the engines at 343 rpm. Engines are 8-cylinder, 16-in. by 20-in., 4-cycle, supercharged units. Four pumps will normally handle the pumping operation with one being used as a standby.

The usual accessory equipment will, of course, be available, including elec-

Work on the Trans-Arabian pipe line goes forward. Neither desert heat nor sandstorms have stopped construction of this vital artery.

tric generators for driving the fans that cool jacket water and lubricating oil. The latter will be used in the air cooling and refrigerating systems, and will supply power for all incidental purposes. Then there are water well pumps, booster pumps, feed pumps, and many others. Six-cylinder engines of the type employed to operate the pumps, will power the generators.

An interesting fact brought out by Johnson is that in a line with multiple stations, each section of which is exposed to sunlight, every station receives a greater volume of oil than it pumps during the day, and, conversely, pumps a greater volume of oil than it receives during the night. The difference is substantial, and becomes an important factor in operations. The complete effect for the Trans-Arabian Pipe Line has not yet been determined, but it is not being overlooked. Nor had it been decided at this writing whether or not the stations would be operated with open or closed suctions. There are good arguments for both types of operation. Damage from overpressuring the line is avoided by the installation of relief valves, and an extra precaution is the addition of over-pressure trips that automatically shut down one or more stations when pressure rises unduly high on station discharge lines.

Scrapers and scraper traps will be utilized to deal with wax, if any, in the cool of the winter season. The traps will also serve other useful purposes, e.g. the removal of air during the filling of the line, the separation of water from the oil that follows it during line tests, and the elimination of the rubbish that collects in any line during the time of construction.

Communications consist of 1000-watt transmitters at the main stations, 300-watt transmitters at the intermediate construction camps, 50-watt transmitters at temporary tent camps, and 15-watt transmitters in the motor units. The installations so far in operation have performed beyond expectation, and communications would not at the moment appear to present any special difficulty.

The entire project has obviously been the subject of long and careful consideration by the engineers and executives involved. It has presented some tough problems in engineering, and their solution has developed very useful information. The readiness of Arabian-American Oil Company to permit open discussion of the reasoning of designers, builders, and operators, is something for which Johnson does not forget to express his commendation, and for which we too find it easy to be grateful. * * *

Texas-New York Line Wants to Expand

Transcontinental Gas Pipe Line Corporation, of Houston, Texas, has plans to expand capacity of its Texas-to-New York City natural gas pipe line, now under construction, from the presently authorized 340,000,000 cu ft per day to a new total of 505,000,000 cu ft.

The company, which estimates cost of the expansion at $50,386,000, is proposing to increase deliveries to its presently authorized utility customers and to extend service to two other utility companies in the East.

The proposed expansion program includes (1) the addition of 10 compressor stations with an increase of 137,120 horsepower in compressor capacity; (2) substitution of approximately 362 miles of 30-in. pipe for the 26-in. pipe now authorized on sections of the line in Texas, Louisiana, Pennsylvania and New Jersey; and (3) construction of 36 miles of line extending from New Jersey to the New York-Connecticut state line.

Transcontinental said it would finance the project by the issuance of $32,000,000 in 3½ to 3⅝% mortgage bonds and $2,650,000 in common stock, a temporary $12,000,000 bank loan, and from funds on hand.

GRIP-TITE STEARNS— PIPE LINE ANCHOR ASSEMBLY

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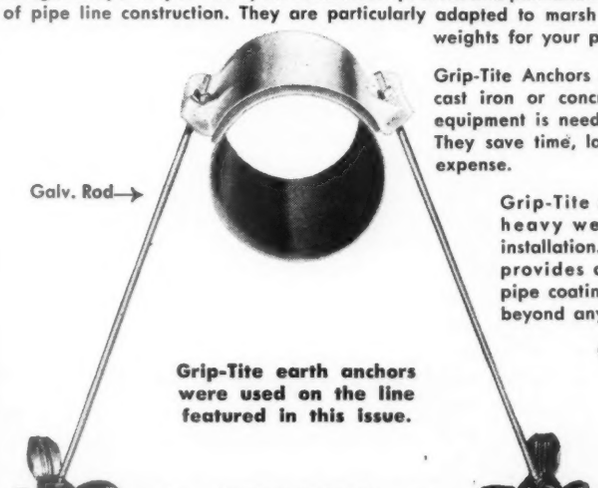
The Grip-Tite Pipe Line Anchor Assembly with Stearns Pipe Saddle was originated and designed especially to meet your demand for positive and permanent hold-downs for all kinds of pipe line construction. They are particularly adapted to marsh and over flow lands as weights for your pipe line.



Grip-Tite Anchors cost only a fraction of cast iron or concrete weights. No heavy equipment is needed for their installation. They save time, labor and other handling expense.

Grip-Tite affords protection from heavy weight damage during installation. An expansion joint pad provides additional protection to pipe coating. They are field proved beyond any doubt.

Comparative cost charts are available upon request.

Grip-Tite earth anchors were used on the line featured in this issue.

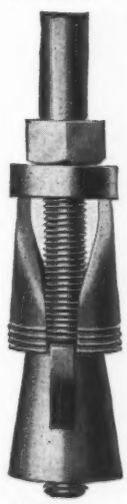
Write for literature.

GRIP-TITE ROCK ANCHORS

Anchor Expanded

Designed to meet the demand of the industry for permanent hold-downs in rock terrain for both pipe line and oil field construction. They are also adaptable as hold-downs in foundations and may also be used above ground in rock terrain in place of Grip-Tite Earth Anchors. Grip-Tite Stearns Pipe Line Anchor Assembly may be equipped with the Rock Anchor instead of Earth Anchor, for above ground pipe line construction in rock terrain.

They are made of CERTIFIED MALLEABLE and so constructed that when load is applied, expanding forces anchor wings against the walls of the hold to effect a positive grip at all times. Corrugations on the bearing surfaces of the wings prevent any slippage. The standard 2" size expands to 2⅝" and is equipped with ¾" rod; 3" size expands to 3⅝" and is equipped with 1" or 1¼" rod. Actual tests of 2" size equipped with ¾" rod show a breaking strength of 20,000 lbs.



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Sold Through Supply Stores

Abrasive Blasting Prepares Pipe Surfaces for Coating

J. F. FARRELL

SCARCITY of steel pipe and accelerated demand for petroleum products, coupled with the high cost of laying and taking up lines, has resulted in increased attention being devoted to the problem of obtaining maximum life from pipe. This has made itself apparent in the expanded use of cathodic protection, coatings and wrappings, and in greater care being given to the preparation of the surface for the application of coatings.

Much money has been spent investigating the effects of sub-soil corrosion, but the fact remains that all commercially economical metals will corrode. The life of a pipe line, therefore, is dependent in considerable measure upon the kind of protection it is given before being put in the ground.

Regardless of the application process or materials employed, a thoroughly cleaned surface is a prerequisite for the best pipe protection. The pipe must be free of dirt, rust, mill scale, and corrosion and, of course, must be thoroughly dry at the time the coating is applied. It has been suggested that light rust and tight mill scale will not affect the bond or accelerate corrosion provided the surface is dry and no moisture is trapped under the rust or scale. Various methods have been tried for eliminating moisture that may be present under these conditions but it is still generally accepted that the safest procedure is to be sure all scale and rust are removed.

Blast Cleaning

Possibly the most thorough method for preparing the pipe surface is by means of blast cleaning. This not only removes every trace of foreign material, but in the case of used pipe it reveals the true condition of the surface. Deep pits that would normally be filled with rust and corrosion deposits are scoured clean so that they can be welded readily or, if they are too bad, inspectors can scrap the pipe and avoid expensive leaks later on in service.

The impact of the thousands of tiny abrasive particles also has the effect of slightly roughening the surface and providing a better anchor for the subsequent coating. This fact has been recognized by manufacturers of various coatings and in a recent survey of the leading manufacturers a uniformity of opinion was expressed. As would be expected there was considerable variation of opinion as to the degree of roughness desired but it was generally accepted that both thorough cleaning and a slight roughening were desirable, and blast cleaning in some form was recommended.

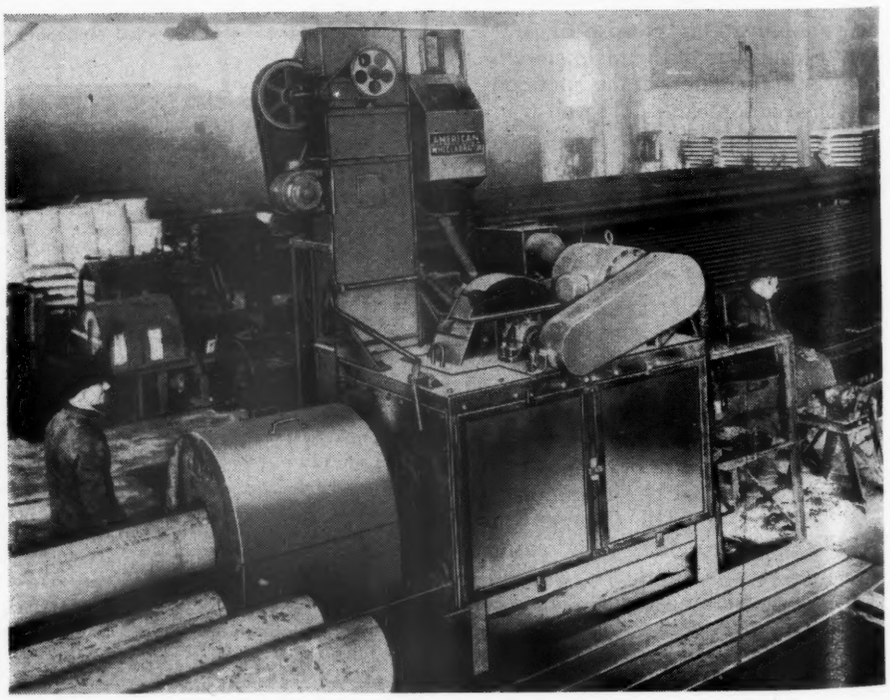
In discussing this problem with representatives of the pipe line contractors a somewhat different attitude was observed. Almost all agreed on the desirability of blast cleaning prior to application of the coating, but, with a few exceptions, the general attitude seemed to be that the pipe line operator should decide whether blast cleaning was to be employed.

The cost of the blast cleaning operation varies somewhat with the conditions of the job but it is always a small part of the total cost of coating and laying. As an extreme example, take the case of an 8-in. line laid through swamp country at a cost of $1.75 per ft for coating and laying only. In this case, badly corroded, used pipe was laid and the cost of blast cleaning was 8 cents per ft.

In choosing blast cleaning equipment for any job, there are in general two different types available: (1) Air blast and (2) airless blast. Airblast equipment is the older of the two. It uses compressed air to force a stream of abrasive through a nozzle against the surface to be cleaned. The abrasive stream is in the shape of a narrow cone and is moved over the surface manually or mechanically as the situation may require. It has the feature of being adaptable for cleaning deep narrow cavities, such as the interior surfaces of pipe. Virtually any type of abrasive material may be used although metallic abrasives are generally recommended.

In airless blast equipment the abrasive is propelled by means of a bladed wheel that utilizes a combination of radial and tangential forces. The abrasive stream is fan shaped and its di-

FIG. 1. Typical pipe cleaning installation. This machine combines the cleaning and coating operations so that the pipe is coated immediately after cleaning and there is no possibility of rust formation.



EXCLUSIVE

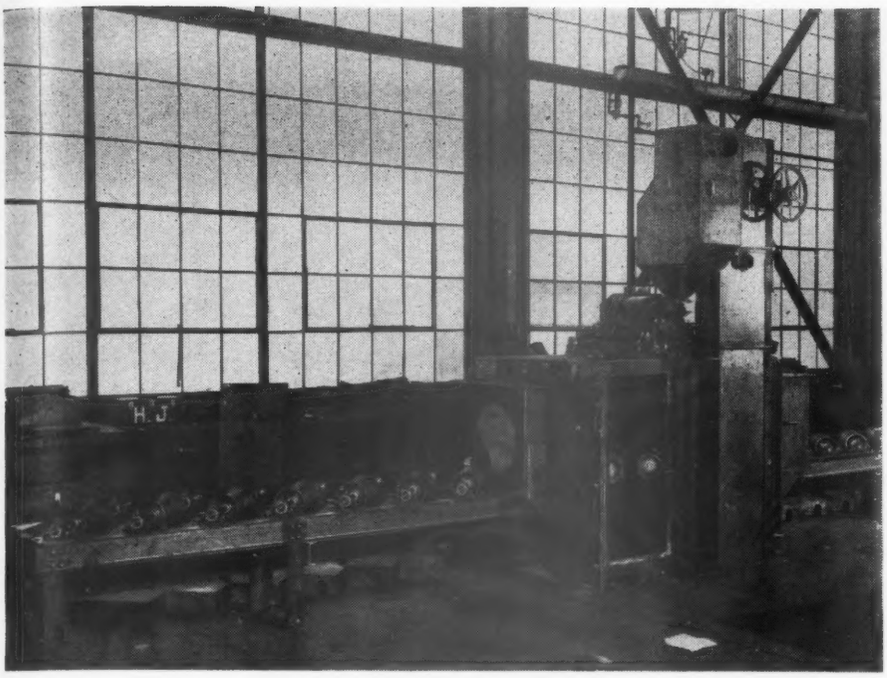


FIG. 2. Blast cleaning cabinet during construction showing skew dished rollers used for conveying pipe through blast chamber.

rection is controlled by means of a control cage in the center of the wheel.

The initial investment for airless blast equipment is usually somewhat greater than for air blast, if ample compressed air is already available, but the efficiency of the airless operation is so much greater that usually it is chosen wherever applicable.

As an example, a one-wheel unit (19½ in. in diam and 2½ in. wide) will throw in excess of 300 lb of abrasive per minute at a cost of 15 hp. To force the same amount of abrasive through five ⅜-in. nozzles at 80-psi pressure requires a 190-hp compressor.

In any cleaning operation the production rate obviously depends to a large extent on the condition of the surface being cleaned and the degree of cleanliness desired by the operator. In the airless blast cleaning of pipe a conservative rule of thumb figure for cleaning rate is 30 sq ft of surface per minute. In actual practice, badly corroded 6-in. pipe has been cleaned at rates of 22 lineal feet (in excess of 37 sq ft) per minute and new 30-in. pipe at the rate of 1000 ft per hr in a two-wheel cabinet or more than 60 sq ft per wheel per minute.

Equipment Designs

The equipment designs used in blast cleaning pipe all follow the same general form of construction. They consist of a cabinet that houses the abrasive propelling device, either nozzles or wheels, the abrasive recirculating system, and conveyors for rotating pipe and moving it through the blast.

The cabinet may be of welded sheet metal construction with a gravity hopper at the bottom into which the spent abrasive drops. A screen removes the large pieces of scale and other material and passes the abrasive and fines to the boot of a bucket elevator, which raises it to an overhead separator and storage hopper. The separator removes the broken abrasive and fines by means of a current of air and returns the clean, usable abrasive to the storage hopper from whence it flows by gravity to the wheel units. A dust collector is usually incorporated with the machine to collect the dust created in the operation.

The wheel units are usually mounted overhead for convenience of operation and maintenance, but they may be mounted underneath and set to throw an upblast stream of abrasive if extreme ranges of pipe sizes must be cleaned in one machine. The reason for this becomes immediately apparent when it is considered that the effectiveness of the blast will vary with the distance of the wheel from the work surface. As the pipe is supported from the bottom, the lower edge of the pipe is in a relatively fixed position regardless of its diameter whereas the upper surface will vary directly as the diameter.

The type of conveyor used also will vary with the diameter of the pipe to be handled. For large diameter pipe a skew disk type conveyor is used, whereas for the smaller sizes a skew dished roller is preferred.

The conveyors are usually con-

FIG. 3. Cleaning interior surfaces of pipe with a long lance type airblast nozzle. Pipe rotates while lance travels through. When lance has returned, completely out of pipe, the pipe is kicked off by the arms and another length rolls into place.

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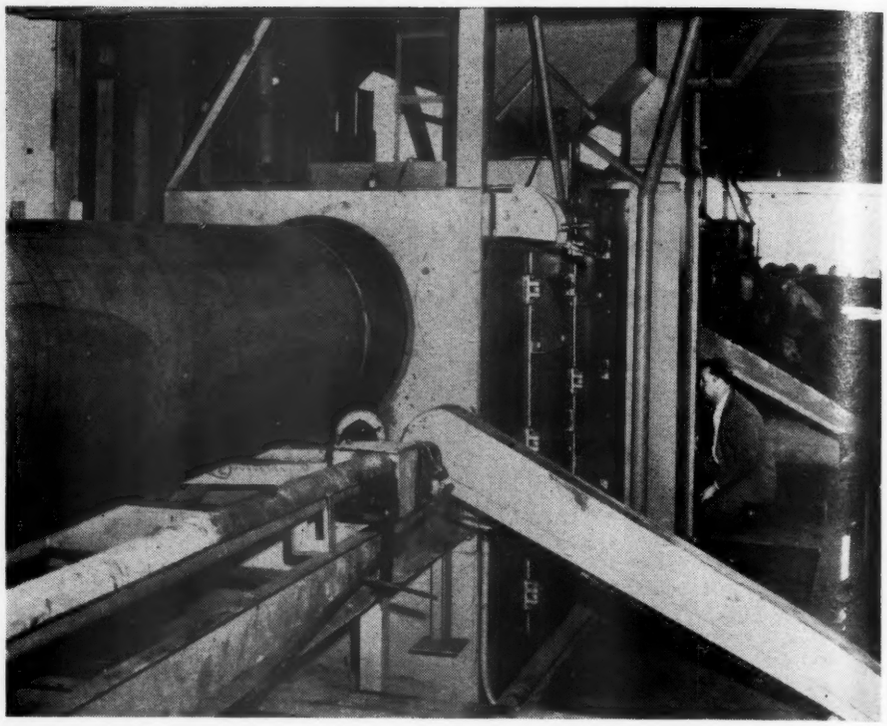

FIG. 4. New 30-in. pipe for the "Biggest Inch" line from Santa Fe Springs to Blythe being cleaned prior to coating. The coating machine follows immediately after the blast cleaning operation.

structed so that the individual rolls can be pivoted about their vertical axes. This changes their angle of contact with the pipe and controls the ratio of revolutions per foot of travel. This in turn affords considerable control over the production rate.

From the above description and from the accompanying installation pictures, it is apparent that this type of equipment is intended primarily for use in yards where the machine can be stationary and sections of pipe fed through. Although the equipment can be made portable, and occasionally is, its primary use is in yard operations. Up to the present time at least no satisfactory traveling machine is available for the general market although considerable effort has been made in this direction.

The H. C. Price Company of Bartlesville, Oklahoma has experimented with a traveling type blast cleaning machine using four wheel units supplied by American Wheelabrator and Equipment Corporation and designed for use on 8-in. pipe. As yet, however, no traveling equipment is available for successfully handling pipe of widely varying diameters after it is once welded.

As pipe so welded obviously cannot be rotated during cleaning it is necessary that enough wheel units be used to provide full coverage over the entire periphery of the pipe. This, plus the abrasive recycling and storage facilities required, makes too much equipment for easy handling.

The choice of abrasive is vitally important in any blast cleaning operation and deserves careful consideration. Sand is one of the oldest abrasives and at one time its use was almost universal. It has now been largely replaced by metallic abrasives, however. These have won their place by virtue of the greatly increased economies effected and are now almost universally used.

The greatest disadvantage of sand and the other non-metallic abrasives is in the wear they cause on the blast cleaning equipment. As an example of this, a top quality nozzle is guaranteed for 750 hr with sand and for 1500 hr with chilled iron abrasive. In the case of airless blast cleaning equipment the differential may be many times greater.

With the recent advent of malleableized shot and grit and true steel shot, equipment wear has been reduced far more. Although these newer abrasives have not had an opportunity to prove themselves conclusively as yet on pipe, the results obtained on a wide variety of cast and forged parts indicate a very real savings in cost with no appreciable loss in production rates for most applications. * * *

EXCLUSIVE

Something New in Aerial Surveying

CHARLES E. BUSH, JR.*

EARLY this year a small group of interested observers watched a demonstration of a new type of pipe line surveying. Flying at 300 ft above terrain, an aerial survey plane made a continuous photograph of a line and simultaneously photographed instruments that gave accurate elevations every 150 ft. Landing, the crew rushed the film through development and in an hour were checking the elevations against a previously acquired profile. Thus in half a day information was obtained that heretofore would have required weeks of effort.

Designed and built by Midwest Aerial Surveys, this new system of surveying employs frequency modulated radar to determine the exact height of the plane above the ground. This is done by measuring the frequency shift between transmitted and reflected waves. During the extremely short time required for the wave to travel to the ground and back to the plane, the transmitter frequency changes. Arriving back at the plane, the reflected wave's frequency is slightly different from that then transmitted. Both the transmitted and reflected waves are then combined in the receiver where the difference in frequency is developed as a beat note. Because the frequency difference becomes larger as the distance to the reflecting surface becomes greater, the altitude of the plane can be determined by converting the beat frequency into a distance indication.

A carefully calibrated friction-free barometric altimeter gives the altitude of the plane above sea level. Subtracting the height of the plane above the terrain from the height above sea level thus provides the elevation at any point of the survey.

To consolidate this information and localize it with respect to the ground required the design and construction of a special camera. Actually two cameras in one, this instrument makes a continuous photograph of the ground—up to 80 miles without changing film—and, at the same time, photographs both the radar and barometric altimeters every 150 ft of the plane's travel. Fully gyro stabilized, which enables it to be used in rough air, the camera employs a variable speed control that enables the operator to control its speed with the image of the ground below.

No shutter is used in photographing the ground. Instead the film is passed over a specially designed slot whose width varies from 0.005 to 0.008 in. To photograph the instruments a conventional rotary "movie" shutter is used. The four film spools are so placed in the camera that complete balance is retained throughout the entire winding cycle.

Although designed primarily for preliminary surveys of proposed pipe lines where an accuracy of only 20 ft is required, greater accuracy has been obtained in tests. Surveys of lines on which profiles were available showed a maximum error of 12 ft with an average error of less than 8 ft. A new reflector antenna now being installed is expected to reduce this error considerably.

* * *

*Midwest Aerial Surveys, Tulsa, Oklahoma.

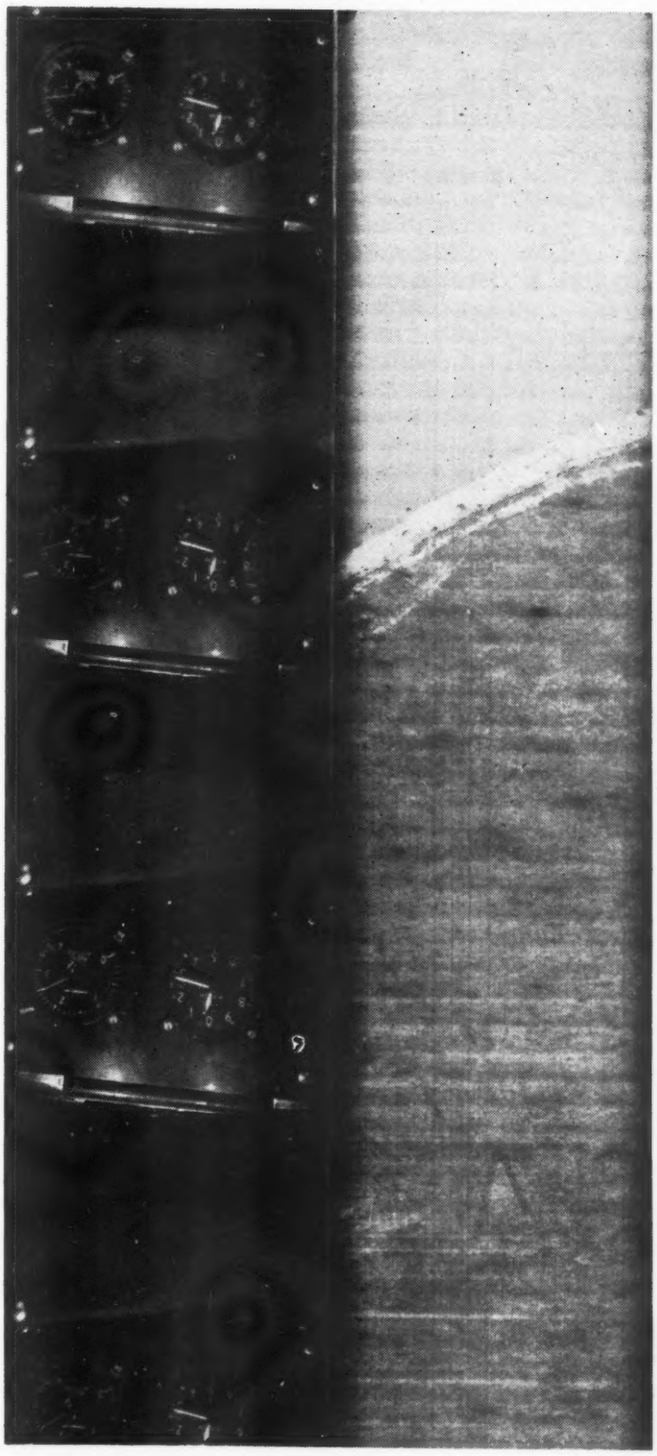

Photo strip showing land sloping down to water. Plane is 280 ft above water level.

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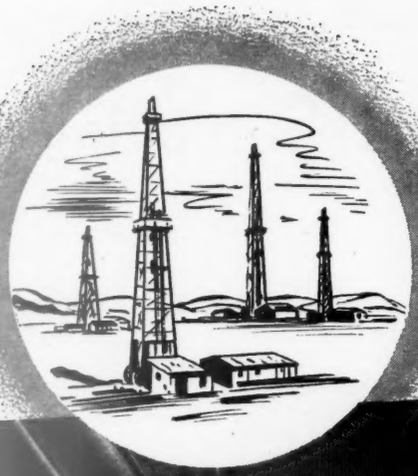

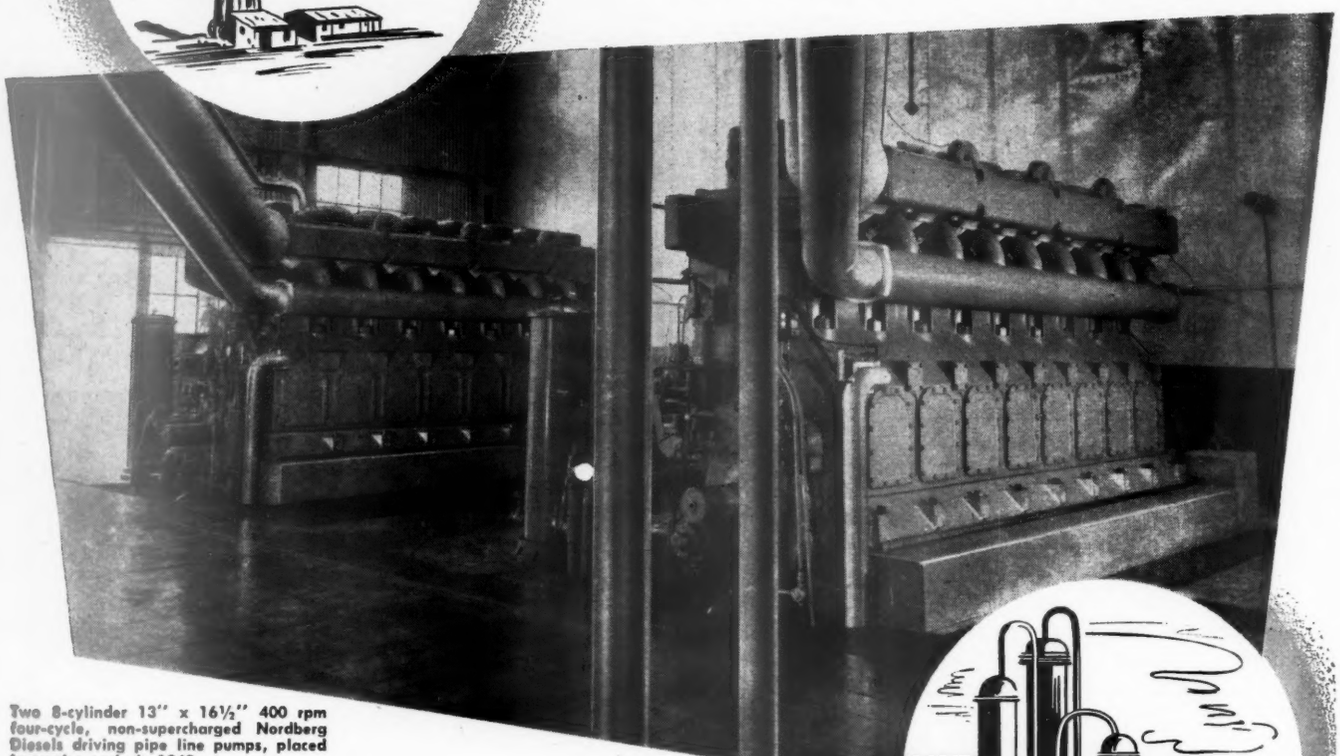

Two 8-cylinder 13" x 16½" 400 rpm four-cycle, non-supercharged Nordberg Diesels driving pipe line pumps, placed in service early in 1949.

FROM wells — to refineries — to marketing terminals — wherever you need a "big push" to get petroleum products on their way in a hurry, you need the kind of dependable, low cost power that Nordberg Diesels provide. These quality-built, heavy-duty Diesels have earned a world-wide reputation for pipe line pumping power at its best. Nordberg Diesel Engines are built in two and four-cycle types in sizes from 10 to 8500 H.P. Conservatively rated, these rugged engines are well suited to a wide variety of requirements ranging from self-contained portable pumping units to permanent stationary installations and generating units for station power and lighting.

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NEWS

Interstate Loans Kahle To Interprovincial Line

The board of directors of Interstate Oil Pipe Line Company has granted an 18-month leave of absence to Loren F. Kahle, president, to enable him to accept a temporary special assignment with Interprovincial Pipe Line Company, Ltd., of Canada. Joseph L. Seger, formerly vice president and general counsel, was elected executive vice president, effective October 1. While retaining his position as president of Interstate and his residence in Tulsa, Kahle will be inactive in the management of its business during the term of his special assignment and Seger will direct the company's affairs during this period.

Kahle's special assignment will take him to Canada for approximately 18 months during which Interprovincial Pipe Line is expected to build a 450-mile crude oil pipe line from Edmonton, Alberta Province, to Regina, Saskatchewan Province, in western Canada. According to previous announcements by the Canadian firm, this line may eventually be extended to the Great Lakes region.

Kahle first joined Interstate as executive vice president when the company was formed in December, 1944, and was elected president on December 20, 1945.

Born in Tronoto, Canada, of American parents, Kahle is a veteran of more than 25 years' pipe line experience in the Standard Oil Company (New Jersey) organization. Much of this service was outside the United States, particularly in Venezuela and Mexico.

Seger joined Interstate as general counsel on June 1, 1946, and in December of the same year was elected vice president and general counsel. Prior to that time, from 1933 to 1944, he had served as an attorney in the legal department of The Carter Oil Company, and in 1944 was elected secretary of Carter.

A resident of Tulsa since his grade school days, Seger received a BS from the University of Illinois, and his law degree from Yale University Law School.

Dr. O. B. Hopkins, president of Interprovincial Pipe Line Company, made the following announcement in Toronto, Canada:

"Mr. Kahle will be in charge of construction and will assist in plans for the operation of the 450-mile Edmonton-Regina line being built by Interprovincial. He has been elected executive vice president and director of the company."

University of Tulsa to Teach Pipe Line Accounting

"Pipe Line Operations and Accounting," first course of its kind, is being offered this fall by the University of Tulsa in cooperation with several major pipe line companies.

The course will instruct employes of pipe line companies and college students who may seek employment with the companies in the most important accounting problems of pipe line operation and how they are being solved by the industry.

J. L. Shoemaker, financial vice president of the Stanolind Pipe Line Company, and J. W. Cason, comptroller of Interstate Oil Pipe Line Company, originated the idea about a year ago. They first had in mind a course to be taught among pipe line companies, but decided the University of Tulsa could offer much-needed facilities as well as train future employes for the pipe line industry. They asked M. M. Hargrove, dean of the College of Business Administration, and R. L. Langenheim, dean of the College of Petroleum Sciences and Engineering, if there would be a place for such a course in the curriculum. Both deans agreed there would be.

J. L. Shoemaker

The present outline of the course was determined by a steering committee made up of men from Stanolind Pipe Line Company, Interstate Pipe Line Company, The Texas Pipe Line Company, Gulf Refining Company, and Tulsa University faculty members.

A text was prepared by the committee members. The material was sent for suggestions and criticism to most of the major pipe line companies throughout the nation, and to the accounting and valuation bureaus of The Interstate Commerce Commission.

Paul J. Graber, professor of accounting, will be in charge of the course. He believes it is the first course of its kind offered anywhere. He explains that pipe line accounting differs from regular accounting in several ways. It is service accounting, he says, which means the pipe line companies do not buy or sell, but offer service only. And pipe line accounting must deal with the Interstate Commerce Commission.

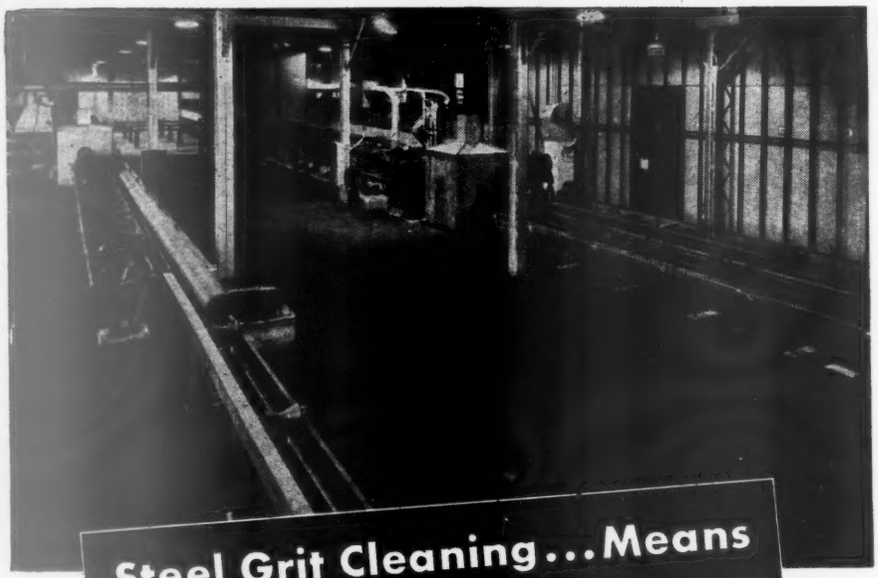
J. W. Cason

Graber stresses that the first semester is strictly experimental. The course is not open to general enrollment and no credit will be given. Forty "guinea pigs," top accountants and engineers from the pipe line companies, will attend the weekly classes. They will listen to the lectures and criticize and suggest improvements. Three or four graduate students also will attend to give the student's opinion. From these sessions will be worked out the final length and scope of the course.

Pipe line personnel will lecture. They are: Emil Wienecke, traffic administrator, T. R. Aude, director of planning and economics; Shoemaker, Stanolind Pipe Line Company, J. C. Rawlins, assistant to the manager, southern division, J. L. Seger, vice president and general counsel; Cason, Interstate Oil Pipe Line Company; Loy J. Shelton, chief supervising clerk, The Texas Pipe Line Company; and E. D. Loughney, assistant secretary and auditor, Gulf Refining Company. M. H. Diels of the University faculty will teach general accounting. These men wrote most of the textbook. Eventually, faculty members will give all the lectures.

Secretarial personnel and facilities for releasing the textbook material in its present form were provided by Stanolind Pipe Line Company. This semester will determine the final form of the text. It will then be published in book form.

Brice Bloodgood has been assigned to the compressor department of Cities Service Gas Company at Wichita, Kansas, as an engineer. He holds an engineering degree from Cornell University and served in the navy and marines during World War II.



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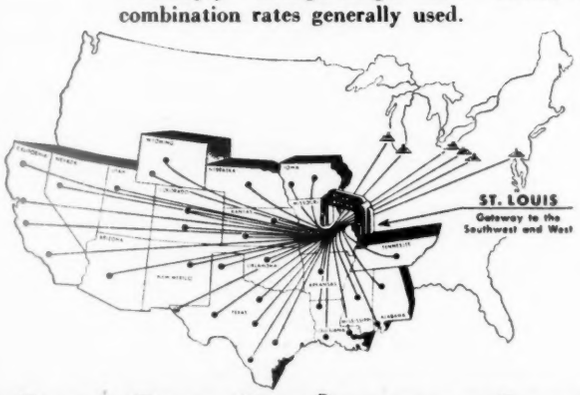

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Another Desulfo Unit Is Installed

Announcement has been made from the Dallas, Texas, office of Stacey-Dresser Engineering, by O. E. McCullough, district manager, that another Stacey-Dresser Desulfo unit has been built. This unit, which is for the Hoosier Gas Corporation in Vincennes, Indiana, processes up to 3,000,000 cu ft of gas a day, reducing the hydrogen sulphide content of the gas to 1 grain per 100 cu ft.

The general office of Stacey-Dresser Engineering, which is one of the Dresser Industries, is in Cleveland, Ohio.

Southern Union Gas Acquires Properties

Albuquerque, New Mexico, became a part of the Southern Union Gas Company distribution system as of the close of business September 30, 1949, when Southern Union began serving natural gas directly to 24,000 customers there following the gas company's purchase of the natural gas distribution facilities in Albuquerque from Public Service Company of New Mexico.

Necessary approval of the transaction by the New Mexico Public Service Commission was given September 27, making possible the completion of the transaction, which involved approximately $4,000,000.

Significance of the transaction, according to C. H. Zachry, Dallas, Texas, Southern Union president, is that Southern Union is now distributing gas directly, rather than indirectly, to Albuquerque. Since 1930, Southern Union has owned the gas distribution franchise in Albuquerque but had assigned the franchise and delivered gas to Public Service Company for distribution in Albuquerque.

The 21-year-old Southern Union is serving 160,000 natural gas consumers in 42 towns and cities in Texas, New Mexico and Colorado. The towns include Austin, Galveston, Port Arthur and El Paso, Texas; Santa Fe, Farmington, Clovis, Portales, Tucumcari and Carlsbad, New Mexico; and Durango, Colorado.

Company headquarters are in the Burt Building in Dallas.

INGAA to Meet

The Independent Natural Gas Association will have a one-day meeting at the Baker Hotel, Dallas, Texas, October 31, according to President A. B. Harper, head of Arkansas-Oklahoma Natural Gas Company. The program is packed with discussions of wide interest.

Transportation Personals

▸ **J. W. "Skipper" Thomas,** West Texas division superintendent of Humble Pipe Line Company, retired recently at the age of 65 after 30 years' service with the company. A retirement party and barbecue was given in his honor in Midland, and attesting to the esteem in which he is held, pipeliners attended from all parts of the country—not just his own associates but high-ranking men from many other pipe line organizations.

It was more than 44 years ago that Thomas first went to work on a pipe line in the famous Spindletop field near Beaumont. After working in the Gulf Coast area for 13 years, he joined Humble Pipe Line Company in 1918 as district foreman at Wichita Falls.

He has been a division superintendent for 26 years, and is one of only two Humble pipe line employes in West Texas with more than 30 years' service.

Thomas became superintendent of the old North Texas-Panhandle division in Wichita Falls in 1926, where he remained until division headquarters were moved to Cisco in 1932. His territory was later enlarged to include West Texas, and in 1935, due to expanding operations, it was again divided with Mr. Thomas becoming superintendent of the West Texas-Panhandle Division.

West Texas-Panhandle headquarters were moved to Midland in 1939, and in 1946 the Panhandle area was transferred to the North Texas division with Thomas remaining in charge of the West Texas division.

During his many years in North and West Texas he supervised construction of almost every major Humble pipe line in the area, watching the company grow from a few miles of lines into its present vast system.

Reminiscing with other old timers at the party, Thomas recalled that his first pipe line job was guarding huge earthen tanks of crude oil in the Spindletop field, scene of Texas' first big oil boom.

"In those days," he said, "storage tanks were just big holes in the ground which held as much as half a million barrels of crude oil. Some had wooden roofs and some were open to the atmosphere, so part of the oil leaked away and part evaporated. But in 1905 it made little difference—oil was not so precious in those days, and people had not found so many uses for it.

Thomas has seen many changes in the pipe line industry since then, among the most noticeable of which are the steel storage tanks that replaced the old earthen facilities.

All kinds of improved mechanical equipment were also adopted, Thomas said. "In the old days we used steam pumping equipment—it was the only kind available. But as soon as possible we installed diesel and electric equipment at pump stations.

"There has been much progress in pipelining since I started, but the most important developments are probably the use of larger lines and more efficient equipment," he summed up.

The party honoring Thomas closed on a humorous note when a group of fellow employes and friends drove up in a pick-up truck loaded with additional gifts—a long-time supply of chewing tobacco and a cuspidor.

Thomas' plans for retirement are indefinite, but he will continue to live in Midland.

▸ **T. J. Skrabanek** has been made superintendent of compressor stations for the Lone Star Gas Company of Dallas, Texas, succeeding **B. L. Rogers** who has retired after heading the department for 35 years. Skrabanek has been Rogers' assistant since September 1, 1947.

▸ **Irvin L. Webb** has been appointed district foreman of Northern Natural Gas Company's newly created pipe line district at Garden Citv, Kansas. He has been crew foreman at Hugoton. Webb will be in charge of the maintenance and operation of the gathering system in the Garden City area and assist in the installation of gathering system facilities in that area.

▸ **William L. Walton,** compressor station engineer at Waskom, Texas, for United Gas Pipe Line Company, and a veteran of more than 20 years' service, died at the age of 60 recently after a long illness.

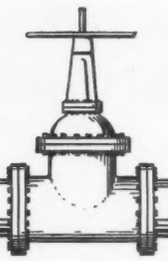
▸ **Seymour Orlofsky,** former division engineer in the compressor department at Jacksonville for Panhandle Eastern Pipe Line Company, has been transferred to the Kansas City office as mechanical engineer and will assist in carrying out the program of the compressor department.

▸ Recent new members of The Pipe Liners Club of Tulsa include the following: **E. V. Grable,** station construction engineer, Stanolind Pipe Line Company, Tulsa; **Sam L. Jackson,** assistant chief engineer, Stanolind Pipe Line Company, Tulsa; **L. A. Manor,** assistant station construction engineer, Stanolind Pipe Line Company, Tulsa; **D. W. McKay,** sales engineer, Cooper-Bessemer Corporation, Tulsa; **J. E. Mims,** engineer, Ozark Pipe Line System, Springfield, Missouri; **Norman F. Schreimer,** engineer, Shell Pipe Line Corporation, Cushing, Oklahoma; **John W. Squire**, engineer, Stanolind Pipe Line Company, Tulsa; **Glen Taylor,** sales engineer, Chas. Wheatley Company, Tulsa; **Burton VerNooy,** chief engineer, T. D. Williamson, Inc., Tulsa; **C. D. Winkelman,** area superintendent, Shell Pipe Line Corporation, Cushing; **A. H. Wurth,** traveling coordinator, Stanolind Pipe Line Company, Tulsa.

▸ **W. C. Cochran,** Denver City, has been promoted from field gauger to district gauger by Shell Pipe Line Corporation. **J. E. Green,** senior engineer (technological), at Cushing, Oklahoma, has been transferred to the company's main office at Houston, Texas. **R. L. McConnell,** assistant maintenance foreman at Prague, has been made maintenance foreman at Newton. **G. A. Morrison,** station chief engineer, Huffman, has been named assistant chief gauger at the Houston tank farm. **J. W. Parks,** station chief engineer at Osage, has been made assistant station chief engineer at the Cushing station on the Ozark system.

▸ **James P. Morgan**, tax commissioner for Sun Oil Company's production department and Sun Pipe Line Company (Texas), represented Texas at the National Conference on Taxation at Boston, Massachusetts, September 19-24.

PIPE LINE PROJECTS



Transcontinental Capacity Increase Is Asked

Transcontinental Gas Pipe Line Corporation has filed an application with the Federal Power Commission for authority to increase the delivery capacity of its 1840-mile natural gas line, now under construction, to 505,000,000 cu ft a day from the 340,000,000 cu ft previously authorized. The enlarged transmission system will extend from Hidalgo County, Texas, to New York City and through Westchester County to the New York-Connecticut state line. Through the Westchester County extension the company will deliver 100,000,000 cu ft of gas a day to Northeastern Gas Transmission Company for distribution in New England.

The company also seeks the commission's permission to increase the delivery quantities to the company's presently authorized utility customers from 302,500,000 to 374,200,000 cu ft a day.

If authorized, the increase in capacity of the line will be accomplished by the addition of ten compressor stations, an increase of 137,120 hp of compressor capacity, and the change in size of sections of the presently authorized line, aggregating approximately 362 miles, from 26-in. to 30-in. pipe.

The application states that construction of the new facilities will proceed simultaneouly with the construction of the presently authorized facilities. It is expected that the entire project will be completed not later than April 1, 1951. The cost of the changes, additions, and extensions is estimated by the company at $50,386,000. The company, in its application, proposes to finance the work by the issuance of $32,000,000 of bonds, the sale of $2,650,000 of common stock through the exercise of purchase warrants now outstanding, and short term bank loans.

Construction of Transcontinental's 12-state system began late in May at Laurel, Mississippi. To date 417 miles of pipe have been unloaded along the right-of-way, 325 miles of right-of-way have been cleared and graded, and 175 miles of pipe have been laid.

In addition to the 605 miles of main line to be laid from Eunice, Louisiana, to Athens, Georgia, the 1949 construction program calls for the complete erection of five compressor stations and a number of important river crossings. The Mississippi River will be crossed with two 24-in. underwater lines. Suspension bridges will carry two 30-in. lines across the Atchafalaya River in Louisiana and one 30-in. line across the Coosa River in Alabama. Seven other rivers, including the Pearl in Mississippi and the Tombigbee in Alabama, will be crossed with single 30-in. under-water lines before the 1949 construction is completed.

Seeks Authority to Construct Ohio Line

Grand River Gas Transmission Company, of Cleveland, Ohio, has asked the Federal Power Commission to authorize the construction of 74 miles of natural gas pipe line in western Pennsylvania and northeastern Ohio. Estimated cost of the project is $1,950,000.

The company proposes to purchase gas from Tennessee Gas Transmission Company at a point near Meadville, Pennsylvania, for transportation either for hire or for resale to delivery points in Lake and Ashtabula counties, Ohio. Tennessee recently was authorized by FPC to construct a Kentucky-to-Buffalo, New York, pipe line that will pass through the Meadville area.

Grand River's proposed project would consist of 42 miles of pipe line between Meadville and Austinburg, Ohio, from which point a 10-mile line would extend north to Ashtabula, Ohio, and a 22-mile line west to Fairport, Ohio. The company said it would transport the gas either for hire or for resale to The Lake County Gas Company, the City of Painesville Gas Department of Public Service, and the Lake Shore Gas Company.

Two other applications involving similar pipe line projects to serve substantially this same area are now pending before the commission. These applications, filed by Erie Gas Service Company, Inc., and Lake Shore Pipe Line Company, both call for Tennessee to supply the gas from connections near Meadville.

Interprovincial Tells Of Financing Plans

Plans to raise the $90,000,000 required to construct its 1150-mile pipe line from Edmonton to Superior, Wisconsin, have been announced by Interprovincial Pipe Line Company.

Dr. O. B. Hopkins, president, said the company proposes to issue in the near future $72,000,000 of 3½ per cent 20-year bonds, $17,000,000 of 21-year 4 per cent convertible sinking fund debentures, and 10,000 of its four million authorized shares of $50 par value capital stock.

The bonds will be offered privately to insurance companies and other institutional investors in Canada and the United States.

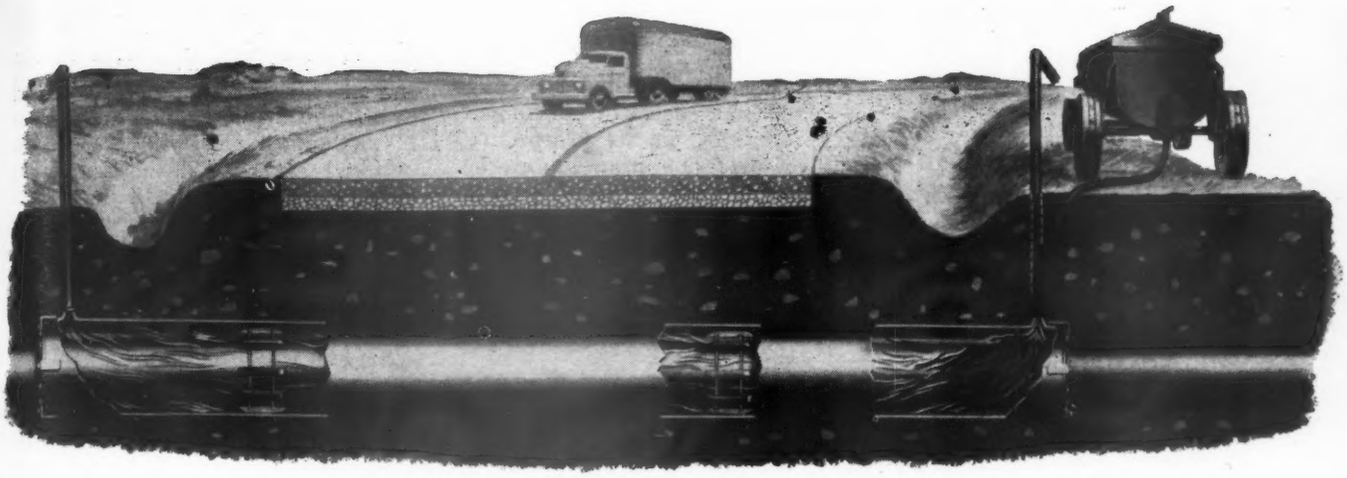
Interprovincial will offer $7,500,000 of the convertible debentures publicly through underwriters in Canada; the balance will be sold privately with Imperial Oil taking a substantial portion. Interprovincial will reserve 340,000 shares for conversion of debentures at the rate of 20 shares for each $1000 of debentures. The Canadian portion of the bonds and debentures will be offered through a group of investment dealers of which Wood Gundy and Company, Ltd., and McLeod Young Weir and Company, Ltd. will be joint syndicate managers.

Of the 20,012 shares of capital stock to be outstanding, Imperial now owns 10,000, 12 are directors' qualifying shares, and the balance will be sold privately by Interprovincial.

A wholly owned U. S. subsidiary of Interprovincial, the Lakehead Pipe Line Company, Inc., will own and operate all facilities in the United States and will issue Interprovincial first mortgage bonds to meet the entire cost of these facilities.

Rate Hearing Postponed

The Federal Power Commission has postponed to a date to be fixed by further Commission order the hearing previously scheduled to commence September 19 in Washington, D. C., in the proceeding involving an investigation instituted by FPC of rates charged by United Natural Gas Company for sale of natural gas subject to commission jurisdiction. The company requested the postponement.



Cutaway of highway crossing showing application of NO-OX-ID Casing Filler. Here 24" pipe has been pushed through a 28" casing; casing bushings assembled and sealed at the ends. Filler is feeding from the portable melting kettle directly into the lower casing vent coupling.

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Mid-Valley Completes Financing Arrangements

The Mid-Valley Pipeline Company has completed arangements for financing construction of its prospective crude oil pipe line from Longview, Texas, to Lima, Ohio.

An issue of $49,500,000 sinking fund bonds, secured by mortgage on the facilities, has been authorized to be issued and sold to a group of institutional investors prior to December 31, 1950.

The Equitable Life Assurance Society of the United States will purchase $33,000,000 of the bonds to be due January 1, 1967, with interest at 3⅛ per cent. A group of six banks, headed by the Chase National Bank of the City of New York, will purchase $16,500,000 of the bonds to be due January 1, 1957, with interest at 3 per cent.

Sinking fund payments on the bonds begin in 1952 and will retire the entire amount issued by maturity.

Interprovincial Line Will Be Extended to Superior

Oil should be flowing through the Edmonton-Regina line by the fall of 1950 and to the Great Lakes at Superior, Wisconsin, by early in 1951, Dr. O. B. Hopkins, president of Interprovincial Pipe Line Company said following hearing of the company's application for a Regina-Gretna extension by the Board of Transport Commissioners in Ottawa. The application has been approved subject to granting of a license to export crude oil by the department of trade and commerce.

Interprovincial received the board's approval June 10 to construct a 450-mile line from Edmonton to Regina. The Regina-Gretna extension is 340 miles. No permit is required to proceed with the final 360 miles from Gretna to Superior.

Dr. Hopkins said the choice of the American route for the final section of the line was indicated by the substantially lower costs than would have been possible over any Canadian route. The distance to the American lakehead is shorter and the country is generally flat, without rocks, and an almost straight line can be followed. Much of the terrain between Winnipeg and the Canadian lakehead is rugged, broken, and covered with bare rock, studded with lakes and muskeg. The physical difficulties and cost of building a pipe line through such territory would make it impracticable.

From Edmonton to Regina the line will be of 20-in. pipe; from Regina to Gretna of 16-in., and from Gretna to the lakes of 18-in. pipe, Dr. Hopkins said. Orders for the purchase of pipe for the entire line have been placed and all deliveries should be completed by the third quarter of 1950. About 177,000 tons of steel will be required.

Initial capacity of the line from Edmonton to Regina will be 95,000 bbl of crude oil a day; east of Regina it will be 70,000 bbl a day. Additional pumping stations can be added as required to increase the capacity of the line.

Survey work on more than 400 miles of the line has already been completed. Actual construction is expected to employ between 1000 and 1500 men for about 150 days and work will probably be in progress at as many as 10 different locations along the line at the same time. Contractors' equipment involved at each point will probably be worth about $500,000.

Terminal facilities at Superior will include loading docks for lake tankers and it is expected that some 57,000 bbl a day will be shipped by tanker to Canadian refineries. As navigation on the Great Lakes is closed for about five months of the year, storage capacity for at least 1,000,000 bbl will be constructed at Superior, which will permit the steady accumulation of oil during the closed season.

Cost of constructing the line has been estimated at $85,000,000. An additional $5,000,000 will be required as working capital, bringing the total projected cost to $90,000,000.

Plant Approved by FPC

The Federal Power Commission has authorized Chicago District Pipeline Company to construct a $6,000,000 plant near Chicago for the purpose of storing natural gas in liquid form during the warm-weather months for use in the Chicago area during periods of peak winter demand.

The plant, to be situated in an isolated area of Will County, Illinois, will have a storage capacity of 400,000,000 cu ft of gas, and will contain facilities for liquefying approximately 4,000,000 cu ft of gas daily and for regasification and return to the system of 6,000,000 cu ft an hr.

The liquefaction process, as described by the company, involves separation and recovery of butane and propane, removal of nitrogen, and storage of gas in liquid form at a temperature below boiling point. The commission said the company recognizes the "extraordinary" hazards to be considered in connection with the construction and operation of the plant, and has assumed full responsibility for the plant's design, construction, and operation.

Would Lay 511-Mile Line in New England

Northeastern Gas Transmission Company, of Boston, Massachusetts, has applied to the Federal Power Commission for authorization to construct a 511-mile pipe line system for the transportation and sale of natural gas at wholesale in the six New England states. Estimated cost of the project is $17,600,000.

The application says that the system would have a capacity of about 350,000,000 cu ft a day, and that the company expects to make deliveries in the latter part of 1950.

According to plans outlined in the application, Northeastern would initially obtain up to 100,000,000 cu ft of natural gas a day from Transcontinental Gas Pipe Line Corporation and 120,000,000 cu ft daily from Tennessee Gas Transmission Company. The company said this total of 220,000,000 cu ft would meet demands for the first two or three years of service.

Northeastern proposes to receive gas at a connection near Greenwich, Connecticut, with the Texas-to-New York line now under construction by Transcontinental, and at various points in Massachusetts through connections with Tennessee's proposed Buffalo-Massachusetts line.

The natural gas would be sold to privately or publicly owned gas pipe lines or distribution systems, the facilities of which would connect with extensions or laterals built by Northeastern from its pipe line system or that of Tennessee Gas Transmission Company, the application says.

FPC Authorizes Arkansas Louisiana Gas Line

The Federal Power Commission has authorized Arkansas Louisiana Gas Company of Shreveport, Louisiana, to construct and operate additional natural gas facilities, including about 163 miles of 20-in. pipe line, in Texas, Arkansas, and Louisiana. Estimated cost of the construction is $7,618,500.

Under the authorization, the company will build a 72-mile line with a capacity of 200,000,000 cu ft of natural gas per day extending from Harrison County, Texas, to Columbia County, Arkansas, and approximately 90.8 miles of line between Columbia County and Perla, Arkansas. The latter line will have a daily delivery capacity of 140,000,000 cu ft, the company said.

Mesabi Pipe Line Withdraws Application

The Federal Power Commission has permitted Mesabi Pipe Line Company, of St. Paul, Minnesota, to withdraw an application filed October 4, 1948, in which the company proposed to construct a 400-mile natural gas pipe line extending from Keokuk County, Iowa, to Itasca County, Minnesota.

Mesabi originally planned to obtain its gas requirements from the northern terminus of a Louisiana-Iowa pipe line that Trunkline Gas Supply Company at that time proposed to construct. Trunkline subsequently submitted an alternate plan that involved a main pipe line extending from Texas to Nabraska, and this latter route was selected by the commission when it authorized the Trunkline project.

To Buy Lines

Texas Eastern Transmission Corporation, of Shreveport, Louisiana, plans to acquire approximately 23,792 ft of 8-in. natural-gas pipe line in New Jersey from Public Service Electric and Gas Company. Estimated cost of the line, which has a maximum capacity of 10,000,000 cu ft per day, is $87,300.

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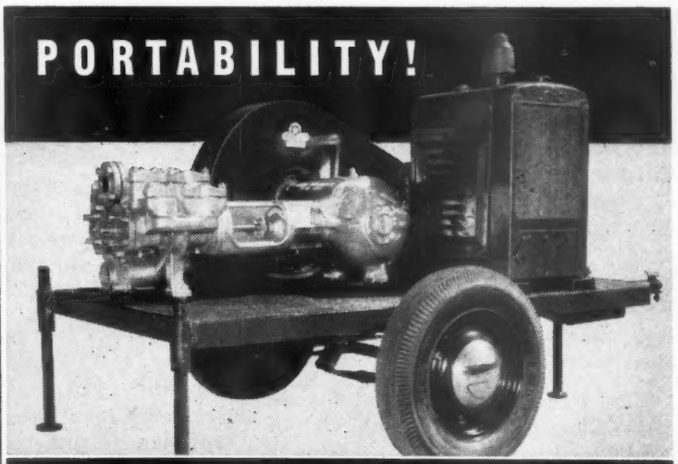

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With the PIPE LINE CONTRACTORS

Midwestern Constructors, Inc., 105 North Boulder, Tulsa, Oklahoma, is laying two sections on the Transcontinental Gas Pipe Line Corporation system, for which Fish Constructors, Inc., are acting as agents. The two sections total 216 miles (30-in.) between Demopolis, Alabama, and Newman, Georgia. M. T. "Bill" Wilhite is general superintendent over both spreads. Field offices are at Selma, Alabama, and Newman, Georgia. At Selma, A. T. Tolbert is office manager. At Newman, Richard Leonard is assistant superintendent, and Phil Whittaker office manager.

The contractor also is laying 80 miles of 26-in. for Texas Gas Transmission Corporation from the Ohio River near Carrollton, Kentucky, to Middletown, Ohio. The field headquarters are at 108½ East Main Street, Madison, Indiana. Carl Stanley is superintendent in charge and E. E. Haworth office manager. Also for Texas Gas, Midwestern is installing multiple 20-in. lines across Green River near Slaughters, Kentucky. Leroy Jackson is superintendent at that point and Kenneth Regan is in charge of the office.

Eastern Construction Company, 1801 Mercantile Bank Building, Dallas, Texas, has completed its third loop for Northern Natural Gas Company. Field headquarters have been moved to Wahoo, Nebraska, and work is in progress on the fourth loop, 21 miles. The general superintendent is J. W. Arthur. Fred Ponder is spread foreman and Fred Harwell office manager.

Pipe will not be received for the Mid-Valley Pipeline Company's job until December; however, some right-of-way work will be done before that time. Eastern Construction will lay sections 3-B and 4-A, 111 miles of 22-in. from a point near Oakland to Henderson, Tennessee, and sections 4-B and 5-A, 111 miles from Henderson to Clarksville, Tennessee.

Fish Constructors, Inc., M. and M. Building, Houston, Texas, is in charge as agents for construction of the Transcontinental Gas Pipe Line Corporation system from the Lower Rio Grande Valley of Texas to New York City. A total of 2239 miles of pipe will be laid including main line and laterals. Scheduled for this year is 612 miles of pipe to be laid and construction of five compressor stations. The pipe is being laid by Morrison Construction Company, Wunderlich Pipe Line Construction Company, Midwestern Constructors, Inc., and Williams Brothers Corporation. The Fish organization is building the compressor stations. Bill Hall is general superintendent in charge of line construction for Fish Constructors, Inc. K. C. Biedermann is division superintendent at McComb, Mississippi, Eldon V. Hunt division superintendent at Selma, Alabama, and J. B. Harshman is manager of the eastern division.

Williams Brothers Corporation, National Bank of Tulsa Building, Tulsa, Oklahoma, is working two spreads on Texas Gas Transmission Corporation's new line that extends from Carthage, Texas, to Middletown, Ohio. The contractor is laying a total of 166 miles of 26-in. pipe. One spread is laying line from Slaughters to Brandenburg, Kentucky. Earl Taylor is in charge of this work. The other crew is laying the line from Brandenburg to the Ohio River, which work is in charge of K. A. Owen. O. L. "Whitey" Martin is general superintendent over both spreads. A multiple river crossing consisting of four 16-in. lines also is being laid by Williams Brothers under the Ohio River at a point near Carrollton, Kentucky. "Fats" McCartney is superintendent.

Work has begun on 112 miles of line for Transcontinental Gas Pipe Line Corporation between Newman and Danielsville, Georgia.

Smith Contracting Corporation, 1410 Fort Worth National Bank Building, Fort Worth, Texas, has laid approximately 55 miles (October 1) of the 168 miles of 8-in. contracted with Salt Lake Pipe Line Company. The section is from Salt Lake City to Burley, Idaho. The field office is at Ogden, Utah. Arnold Smith is superintendent and Ben Mapes office manager.

The contractor has just finished 131 miles of 12¾-in. oil line for The Texas Pipe Line Company between Chico and Corsicana, Texas. Two spreads were employed, Charley Craig being superintendent of one, R. M. Jones superintendent of the other. Three water crossings in Oklahoma for The Texas Pipe Line Company also have been completed. These were of the Ouachita River, Criner Creek, and Walnut Creek. Jack Landers supervised this work.

N. A. Saigh Company, Inc., Suite 531 Majestic Building, San Antonio, Texas, has begun construction on the 103-mile section between Carthage, Texas, and Sharon, Louisiana, of Texas Gas Transmission Corporation's line. This part of the system will be of 20-in. diam pipe. Also for Texas Gas, a multiple river crossing is being installed across the Mississippi at Greenville, Mississippi. This will consist of four 16-in. high pressure lines, each approximately 15,000 ft long extending from the land side of the east levee to the land side of the west levee. The field office for the river job is at 220 Main Street, Greenville. Carl Doyle is superintendent, James E. Gray office manager, J. T. Holder welding foreman, and Orville Jenkins pipe foreman.

Associated Pipe Line Contractors, Inc., P. O. Box 2163, Houston, Texas, is finishing up the 122 miles of 26-in. it is laying for Texas Eastern Transmission Corporation from Somerset to Lebanon, Ohio. Key personnel include: J. A. Williamson, general superintendent; L. H. Gray, spread foreman; A. B. Johnson, office manager; James Luther, timechecker; W. F. Van Cleave, timekeeper; J. N. Lowrance, purchasing; Homer Cotter, pipe foreman; Keller Davis, welding foreman; E. J. Reynolds, right-of-way foreman; Brit Forse, road crossing foreman, and Roy Connors, ditch foreman.

The contractor is not scheduled to begin work until December on the Mid-Valley Pipeline Company crude oil line. The section contracted to Associated is 111 miles between Mayersville, Mississippi, and a point near Oakland, Mississippi. Pipe diameter will be 22 in.

O. C. Whitaker Company, 804 Dan Waggoner Building, Fort Worth, Texas, has just completed two jobs. One was 86.17 miles of 26-in. for Texas Gas Transmission Corporation from Greenville to Lula, Mississippi. The other was 65 miles of 20-in. for United Gas Pipe Line Company between the Baxterville field, Mississippi, and Mobile, Alabama. J. C. Minyard was general superintendent over both jobs. The spread foreman on the Texas Gas line was J. T. "Borger Red" McMenamy. Jimmy Reid and Merle Tatom were spread foremen on the United Gas job.

Dunn Brothers, 1420½ Wood Street, Dallas, Texas, (stringing contractors), had strung (to September 22) 115 of the 180 miles being strung for Morrison Construction Company on the Transcontinental Gas Pipe Line Corporation job. The field office is now at New Roads, Louisiana, with H. E. Taylor in charge.

In West Virginia and Maryland 130 miles of 26-in. had been strung for H. C. Price Company on the Virginia Gas Transmission Corporation and Atlantic Seaboard Corporation system. This left 70 miles. Headquarters are at Elkins, West Virginia. H. G. Taylor is superintendent.

About 35 per cent of the job had been completed on the Salt Lake Pipe Line Company job between Burley and Boise, Idaho, for Oklahoma Contracting Company. A total of 151 miles of 8-in. will be strung. Art Kane is in charge, with the field office at Burley.

Work was resumed the latter part of September on the Alabama-Tennessee Natural Gas Company 10-in. 82-mile line from Selmer, Tennessee, to Florence, Alabama. This job had been shut down due to lack of pipe and only 10 miles had been strung prior to resumption of work. The general contractor is Lehman-Hoge and Scott. Dunn Brothers have their field office at Corinth, Mississippi, with C. D. Blankenship the superintendent.

R. B. Potashnick, Cape Girardeau, Missouri, is laying a 24-in. loop to Mississippi River Fuel Corporation's line between Perryville, Louisiana, and Fredericktown, Missouri, approximately 218 miles. W. C. Allred is the superintendent in charge of construction.

Anderson Brothers, P. O. Box 2591, Houston 1, Texas, is laying 46 miles of 26-in. for Panhandle Eastern Pipe Line Company at various locations on its system. At Holden, Missouri, 24 miles are about 50 per cent completed (September 19). Dewey Whitworth is superintendent. At Bluffton, Indiana, 15 miles were 95 per cent completed on the date mentioned, and work began about that time on 7 miles at Napoleon, Ohio. Ralph Pitts was in charge of both jobs. With Rusty Killingsworth in charge, work was just getting under way on 62 miles of 10-in. at Staughton, Wisconsin, for the Michigan-Wisconsin Pipe Line Company. Twenty miles of 10-in. was being laid for the same company at Racine, Wisconsin, with J. A. Brown the superintendent. Two spreads were employed on Tennessee Gas Transmission Company work. At Morehead, Kentucky, 44 miles of 26-in. was being laid and had been 5 per cent completed September 19. Arkie Hobson is superintendent. At Winchester, Kentucky, 33 miles of 30-in. was 10 per cent completed, with E. E. McCoy the superintendent. A short line, 8 miles of 8⅝-in. pipe, was being laid near Kansas City, Kansas, for Phillips Pipe Line Company. With Raymond Ellison in charge, this job was 10 per cent completed. Work began October 1 on 70 miles of 20-in. for the Arkansas Louisiana Gas Company between Waskom, Texas, and Magnolia, Arkansas.

Bechtel-Price-Conyes, 220 Bush Street, San Francisco, California, has its field office at Paicines, California, for the Pacific Gas and Electric Company job. This 506-mile, 34-in. line will extend from Topock, Arizona, to Milpitas, California. The work is now in the vicinity of Hollister, California. R. L. Bowman is the superintendent in charge and Steve Valline is the office manager.

Bechtel Corporation, 220 Bush Street, San Francisco, California, is applying Somastic coating to 120 miles of 8-in. pipe for the Salt Lake Pipe Line Company. The pipe will be laid from the Salt Lake Refinery toward Boise, Idaho. A railhead plant has been set up at Ogden, Utah, with Leon Garrot the superintendent in charge.

T. and L. Construction Company, Centralia, Illinois, began work September 20 on 25 miles of 4-in. for the Iowa-Illinois Gas and Electric Company between Oskaloosa and Ottumwa, Iowa. The field office is at Oskaloosa. H. E. Carter is superintendent and Jack Thompson office manager. The company also is laying 16 miles of pipe of various sizes near Nashville, Illinois, for Shell Oil Company, Inc. The gang is working out of Centralia. Oscar Barnes is superintendent.

Williams-Austin Company, 707 Grant Building, Pittsburgh, Pennsylvania, began 23 miles of 12-in. September 26 for Central Kentucky Gas Company near Mt. Sterling. Ralph Gaddy is the superintendent. Gaddy also has been in charge of laying 39 miles of 14-in. for the Peoples Natural Gas Company between Somerset and Johnstown, Pennsylvania, which was finished September 30. There were recently completed for United Fuel Gas Company 14 miles of 8, 10, and 12-in., and five miles of 12, 16, 18, and 20-in. in West Virginia. H. C. Bauer was superintendent of both jobs. The contractor also has made an 8-in. crossing of the Ohio River at Ashland, Kentucky, for United. Ed Peters is general superintendent for the company.

Ray L. Smith and Son, Inc., Box 391, El Dorado, Kansas, is laying 65 miles of 26-in. pipe from Clendenin, West Virginia, northeast for the Atlantic Seaboard Corporation. Progress has been slowed down considerably by rains and rough terrain. The field office and warehouse are at Gassaway, West Virginia. Joe L. Work is general superintendent, Wm. G. Frost spread superintendent, J. H. Salisbury office manager, and M. O. Newby welding foreman.

Morrison Construction Company, Inc., P. O. Box 798, Austin, Texas, has completed 43 miles of 12-in. for the United States Atomic Energy Commisison near Los Alamos, New Mexico.

The contractor also has two other jobs under way:

For Transcontinental Gas Pipe Line Corporation, 180 miles of 30-in. between Bassfield, Mississippi, and Eunice, Louisiana.

For Tennessee Gas Transmission Company, 90 miles of 30-in. in Tennessee and Kentucky.

J. O. "Red" Willett, Monroe, Louisiana, (stringing contractor), is stringing 101 miles of 26-in. pipe for Latex Construction Company between Sharon, Louisiana, and the Mississippi River at a point south of Lake Village, Arkansas. Latex is laying this line for Texas Gas Transmission Corporation.

For Wunderlich and Griffis Pipe Construction Company, on the Transcontinental Gas Pipe Line Corporation job, Willett is stringing 110 miles of 30-in., and for Transcontinental is unloading and racking 425 miles of 30-in. pipe.

Between Lebanon and Lancaster, Ohio, 122 miles of 26-in. pipe is being strung for Associated Pipe Line Contractors, Inc., on the Texas Eastern Transmission Corporation job.

H. L. Gentry Construction Company, Jackson, Michigan, will begin work in December on Section 6-B of Mid-Valley Pipeline Company. This section will consist of 111 miles of 22-in. from Elizabethtown to Hebron, Kentucky.

Wunderlich and Griffis Pipe Construction Company, 745 Riverside Drive, Tulsa, Oklahoma, is making good progress on Schedule No. 3 of the Transcontinental Gas Pipe Line Corporation system. The section consists of 110 miles from Highway 42 in Mississippi to the Tombigbee River in Alabama. C. W. Broome is construction superintendent and field headquarters are at Laurel, Mississippi.

H. C. Price Company, Union National Bank Building, Bartlesville, Oklahoma, is working three spreads on the Atlantic Seaboard Corporation and Virginia Gas Transmission Corporation line. One spread is laying 68 miles starting near Mouth of Seneca, West Virginia, and extending to a point near Cleveland, West Virginia. The field office is at Elkins, West Virginia, phone 1945. W. B. Williams is superintendent and P. O. Rutledge office manager. Foremen are: D. L. Beachy, R. H. Edwards, and Rube Owens, right-of-way; K. K. Kelly, ditch; Roy Stegall, bend; J. I. Cobb, pipe; C. F. Jones, weld; A. D. Hamilton, lower-in, and Fred Williams, clean-up.

Starting near Mouth of Seneca and working to a point near Strasburg, Virginia, a second spread is laying 70 miles. The field office is at Woodstock, Virginia. C. R. Ice is superintendent and G. A. Harvey office manager. Foremen: John Hamilton, right-of-way; E. W. Whisenant, ditch; Forest Loinette, bend; L. L. Smith, pipe; L. O. Reutzel, weld; J. C. Rich, coating, and N. D. Adams, lower-in.

The third spread is laying 68 miles from Strasburg to Atlantic Seaboard's main line near Rockville, Maryland. This spread also is making two major river crossings, four 16-in. lines each across the Potomac and Shenandoah rivers. The field office is at Rockville, phone 4316. R. K. Shivel is superintendent and Ray Stokes office manager. Foremen are: J. D. White, right-of-way; W. H. Olrich, ditch; J. H. Latham, bend; C. E. Shivel, pipe; R. L. Ezell, weld; U. M. Beaver, coating; G. E. Beaver, lower-in; Sam Price, clean-up, and Ray Drewall, crossings. All pipe is 26-in.

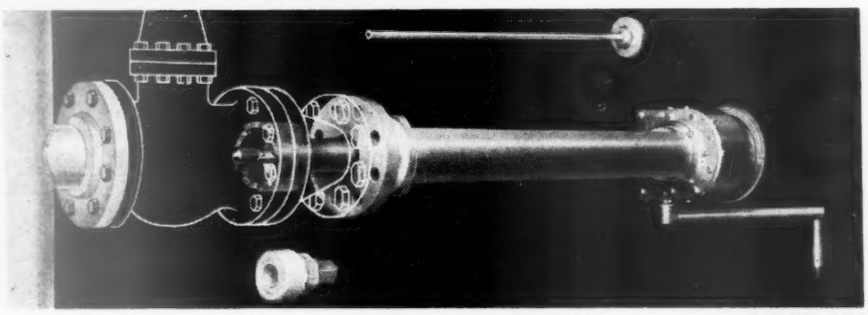
For Tennessee Gas Transmission Company, approximately 50 miles of 30-in. is being laid from the west bank of the Mississippi River near Greenville, Mississippi, to a point near Rulville, Mississippi. Several river crossings also will be laid, the principal one being the Sunflower. This contract was let to H. C. Price Company and Bechtel Corporation, Price, the sponsor party, handling construction. The field office is at Leland, Mississippi, phone 147-W. G. A. Reutzel is superintendent and W. E. Yount office manager. Foremen: J. A. Hairston, right-of-way; L. Loncarich, ditch; J. Anderson, bend; H. C. Morrison, pipe; R. W. Orr, weld; S. J. Wood, coating; Athel Bell, lower-in, and T. E. Walker, clean-up.

Trojan Construction Company, Inc., P. O. Box 4427, Oklahoma City 9, Oklahoma, has two jobs under way for Shell Pipe Line Corporation that it expects to complete by the last day of the year. One is taking up 190 miles of 10-in. between Cushing, Oklahoma, and Emmitt, Missouri, which is no longer needed since the Ozark Pipe Line System was completed. The pipe is being reconditioned and 160 miles are being re-laid from Cushing to the new Elk City, Oklahoma, field. On the takeup, Maurice Crawford is spread man and Bill Skinner field office manager. At the reconditioning yard, T. J. Shelton is foreman and John Miller field office manager. Laying is in charge of Swede Tillotson as spread foreman with Vernon Yeager manager of the field office.

Shamrock Construction Company, P. O. Box 216, Chetopa, Kansas, has its field office at McComb, Mississippi, for the double-jointing work it is doing for Fish Constructors, Inc. agent for Transcontinental Gas Pipe Line Corporation. The McComb address is P. O. Box 663, and the telephone number 1013. A total of 292 miles of 30-in. pipe is being double-jointed, 180 miles of which is being laid between Eunice, Louisiana, and Bassfield, Mississippi, and 112 miles from the latter point to Tombigbee River in Alabama. The men in charge of the work are: J. C. "Preacher" Brown, superintendent; L. R. "Stovepipe" Coulter, welding foreman; S. B. "Stamps Ark." Walter, spacing; F. G. Hindman, office manager; Paul W. Upton, timekeeper; and N. B. Stietenroth, accounting.

Oman-Fulton-Brodie, P. O. Box 30, Gallatin, Tennessee, are constructing the 172-mile, 22-in. line for East Tennessee Gas Company from Greenbrier to Oak Ridge, Tennessee. Spread No. 1 has moved to Cookeville. Charles E. Fry is superintendent. Spread No. 2 is making its headquarters at Harriman, Tennessee. A. A. Carrigan is superintendent. J. T. Brodie is general superintendent. This is a joint venture of Oman Construction Company, Nashville, Tennessee; Brodie Construction Company, Amarillo, Texas, and R. H. Fulton and Company, Lubbock, Texas.

Sheehan Pipe Line Construction Company, 529 National Bank of Tulsa Building, Tulsa 3, Oklahoma, has two spreads working on 103 miles of 12-in. for the Great Lakes Pipe Line Company between St. Paul and Albert Lea, Minnesota. Work began September 19 on 9.5 miles of 20 and 24-in. from Granite City to East St. Louis, Illinois, for Mississippi River Fuel Corporation.



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Oklahoma Contracting Company, 1210 Mercantile Bank Building, Dallas, Texas, had laid 37 miles of pipe for the Salt Lake Pipe Line Company to September 22. The company is constructing 151 miles of 8-in. products line between Burley and Boise, Idaho. The field office is at Twin Falls, Idaho, with Aldress Kilgore superintendent and Dick Mueller office manager.

The Michigan-Wisconsin Pipe Line Company job is scheduled for completion October 15-20. This job consists of approximately 200 miles. The field office is at Valparaiso, Indiana. H. A. Wylie is general superintendent, Robert Hall office manager, and C. W. Goodwin welding foreman.

At the present rate of construction the 102 miles of 26-in. being laid for Texas Gas Transmission Corporation from Fulton to Providence, Kentucky, will be completed about November 1. The field office remains at Princeton, Kentucky. L. B. Rea is superintendent, "Bull" Stewart assistant superintendent, R. B. Pryor office manager, and H. A. Rowden welding foreman.

Latex Construction Company, 2707 Ferndale Place, Houston, Texas, is now working on 91 miles of 20-in. line for Arkansas Louisiana Gas Company from Magnolia to Malvern, Arkansas. Two spreads are in the field, with E. C. Norris the general superintendent. Headquarters at Arkadelphia, Arkansas, have H. L. Leake as spread superintendent and S. B. Harrison and L. F. Redfearn in the office. At Prescott, Arkansas, R. E. Thornton is spread superintendent and R. J. Axsom office manager.

When Mid-Valley Pipeline Company announced contracts recently for its crude oil line from Longview, Texas, to Lima, Ohio, Latex was given several jobs, as follows:

From Haynesville, Louisiana, to the Mississippi River north of Lake Providence, 120 miles of 20-in. From Haynesville to Stevens, Arkansas, 22 miles of 8-in. and 12 miles of 6-in. laterals will be laid. Headquarters are at Magnolia with O. R. Mitchell spread superintendent. This work has begun.

From Delhi to Lake Providence, 41 miles of 12-in. laterals. Field headquarters are at the latter point.

Mississippi River crossings consisting of two 20-in. lines, north of Lake Providence. J. A. Cantrell is superintendent. This work also has begun.

Crossing of the Red River near Benton, Louisiana, for Mid-Valley Pipeline Company. H. E. Murphy is superintendent. This will be a single 20-in. line.

Latex also has contracted to cross the Red River for Texas Gas Transmission Corporation with two 16-in. lines near Curtis, Louisiana. For this same company work is being wound up on the 101 miles of 26-in. from Sharon, Louisiana, to the Mississippi River south of Lake Village, Arkansas. On this job W. H. Hayes has been superintendent, M. L. Thompson assistant superintendent, and A. E. Stremmel office manager.

J. R. Horrigan Construction Company, Commerce Building, Houston, Texas, will have completed its work on the Michigan-Wisconsin Pipe Line Company system by November 1, according to present indications. The main line of this 1160-mile system from the Hugoton gas field to distribution points in Michigan and Wisconsin has been laid wholly by the Horrigan Company except for approximately 200 miles, which was constructed by the Oklahoma Contracting Company. Ben Law is the general superintendent. Spread foremen are J. F. Flannagan, Louis Visentine, and M. E. Shifflet.

The contractor is finishing up the Texas Gas Transmission Corporation job after being shut down due to lack of pipe with only 15 miles left to go. This consisted of 110 miles of 26-in. from Memphis, Tennessee, to Fulton, Kentucky. Lately the field office has been at Halls, Tennessee. W. H. Law is general superintendent, Henry Cook spread foreman, and Gene Gohring office manager.

Mahoney Contracting Company, Mt. Pleasant, Michigan, is laying Section 7 North of the Mid-Valley Pipeline Company project, 60 miles of 20-in. from Eaton to Lima, Ohio.

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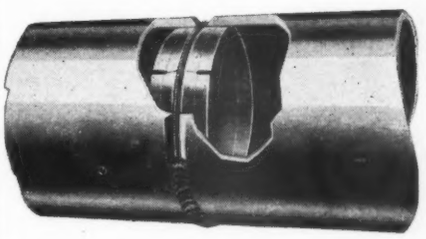

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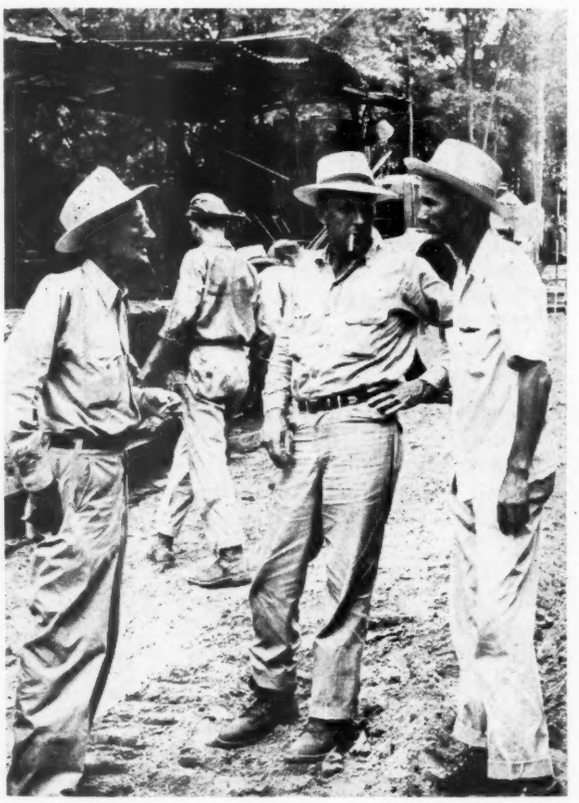
Pictorial

On these pages are shown some of the men concerned with construction of the Texas Gas Transmission Corporation system.

Oklahoma Contracting Company officials. R. J. O'Connell, vice president; Paul R. Halbert, vice president; T. A. Hester, president; N. K. McFarland, secretary-treasurer, and T. R. Jones, chairman of board.

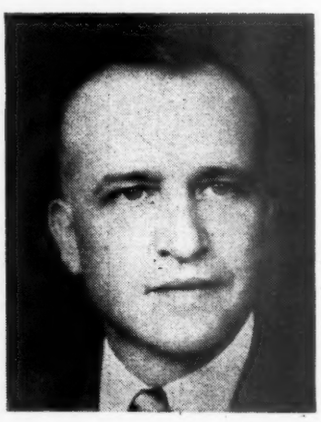
Virgil Bull, foreman, and Joe G. McMaken, general superintendent, Omaha Dredge & Dock Company, at Tennessee River crossing.



Earl Taylor, spread foreman for Williams Brothers; O. L. "Whitey" Martin, general superintendent for Williams, and Roy Ray, chief inspector for Texas Gas on Spread No. 8.

Midwest Constructors, Inc.

F. E. Stanley
President



C. C. Bledsoe
Secretary-Treasurer

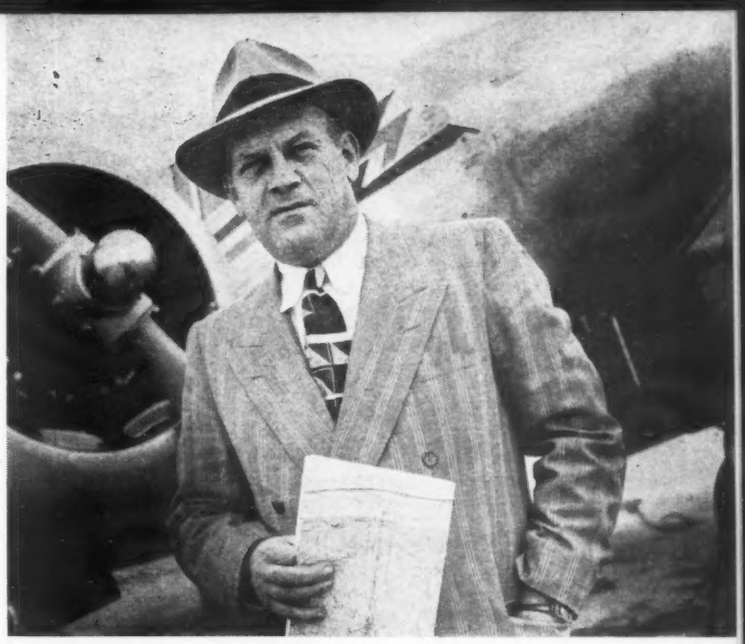
J. R. Horrigan company

W. H. Law
Superintendent

N. A. Saith Company, Inc.

N. A. Saith
President

Carl Stanley, superintendent for Midwestern Constructors, Inc., and D. L. Franklin, chief inspector for Texas Gas.



J. R. Horrigan, head of J. R. Horrigan Construction Company.

C. R. Kersey, welding inspector for Texas Gas; Bill Fogleman, chief inspector, and Virgil Bull, foreman for Omaha Dredge & Dock Company, at Tennessee River crossing.

Tom Stanley, pipe and ditch inspector for Texas Gas, and J. T. "Borger Red" McMenamy, spread foreman for O. C. Whitaker Company.

Williams Brothers Corporation Officials

S. M. Williams, Jr.
President

G. S. Connors
Vice President

David R. Williams
Vice President

C. A. Stanfield
V. P. and Treasurer

MARINE OPERATIONS

52 Tankers Contracted By U. S. Shipyards

U. S. shipyards report that there were 61 vessels of 968,523 gross tons and 1,459,175 deadweight tons under construction or on order as of August 1, of which 52 were tankers aggregating 1,381,525 deadweight tons. Launched recently by the Newport News Shipbuilding and Dry Dock Company yard was the supertanker *Atlantic Emperor* for the Atlantic Maritime Company. *Atlantic Emperor* is of the 26,000-dwt class and has a volumetric cargo capacity of 230,000 bbl, and a designed speed of 16 knots. At the same time, the Sun Shipbuilding and Dry Dock Company launched the 26,875-dwt tanker *Sovac Pegasus* for Tanker Navigation Company.

Socony-Vacuum Has New Albany Wharf

Completion of a new wharf at its bulk terminal in the Hudson River at Albany is announced by the Socony-Vacuum Oil Company, Inc. The wharf replaces two breasting barges used previously at the terminal and is 50 ft long by 25 ft wide, supported by steel pilings and surfaced with concrete. In addition, the river bed was dredged to 27 ft at the wharf to facilitate the tankers' movements. A 33-ft walkway, which also supports pipe lines to the tanks, connects the wharf with the shore.

A feature of the wharf is a new type of hose frame for more efficient unloading of tankers. It is 24 ft long and 17½ ft wide, permitting a number of hose-lines to pump simultaneously from a vessel. These lines are connected with storage tanks from which, in turn, products such as gasoline, kerosine, and home-heating oil are loaded on railroad tank cars, motor trucks, and canal barges.

A dolphin of interlocking sheet piling, filled with rock and capped with concrete, on which a "dead man" for securing tankers is placed, was erected north of the new wharf. A second dolphin 15 ft long and 10 ft wide was erected below the new wharf.

Chinese Built First Tanker in 1700

The history of the oil tanker has now been traced back as far as 1700, according to an article appearing in *Fleet News*, a quarterly magazine published by the Imperial Oil Company, Ltd. According to the article, "The Tanker Story," the first "really practical" step was taken by the Chinese who built the "first real tanker vessel." She was constructed as a water carrier but was later used for petroleum and held about 50 tons. The next major sign of progress, according to the article, came from the Russians under Peter the Great who issued regulations governing the movement of oil up the Volga in 1725. By 1753, oil was being loaded in bulk into barges.

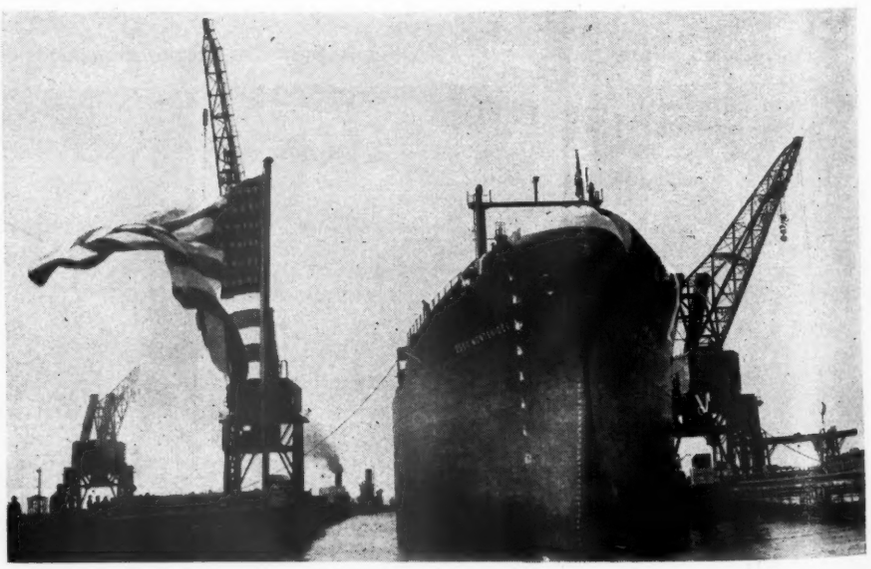
A group of Canadian oil men first put forth the idea of building ships with tanks for oil in 1862, while in 1863 an Englishman, Henry Duncan, chartered the first seagoing vessel in modern times to carry oil in her hold. In the same year, an iron sailing tanker, the *Ramsey*, was built on the Isle of Man. Competition in the oil trade called for progress in the development of bulk carriers, and in 1864 there were ships completed with their own pumps and having iron tanks.

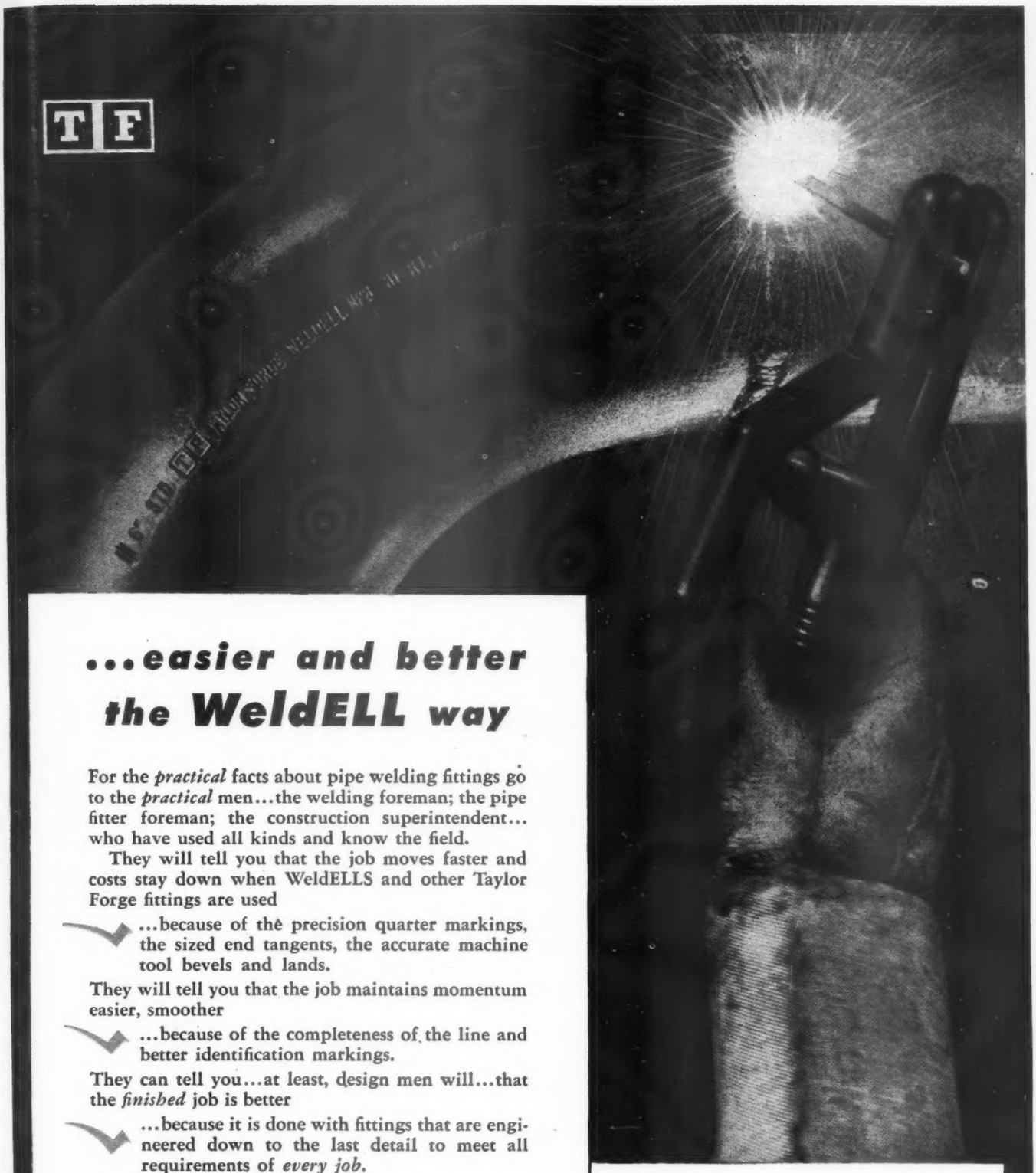
The construction of the *Gluckauf* in 1886 in England was the beginning of the tanker "as we know it." She was the first vessel to be registered as a "petroleum steamer." Two years later the first tanker to be constructed in the United States was built, this being the *Standard*—the first vessel in the Standard Oil Company's fleet. Gradually tankers grew and gained in efficiency, and in 1892, the first tanker was allowed to proceed through the Suez Canal. The article states that the chief criticism directed at the tanker concerns the fact that she is a "one way carrier," and in this connection, the article regards the *G. Harrison Smith* as the most important of the dual purpose tankers. This vessel loaded California fuel oil for Chile and brought back iron ore for American steel mills.

Tanker San Silvestre Completes Trials

Trials have been completed by the tanker *San Silvestre*, a turbo-electric driven 15,900-dwt ship built by the Furness Shipbuilding Company, Ltd., of Durham, England for the Eagle Oil and Shipping Company, Ltd. Built on the combined system of transverse side framing, with longitudinal bottom, the vessel has tank space divided into nine compartments, eight being treble and one quadruple.

Supertanker Esso Montevideo Launched. Another supertanker is launched to join the growing fleet of such tankers. The *Esso Montevideo*, pictured here as it was launched recently at the Newport News Shipbuilding and Dry Dock Company yard, is powered by General Electric 12,500-hp geared turbines. Its speed is in excess of 16 knots.





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Oil in Venezuela[1]

JOSEPH E. POGUE

PART 1

Introduction[a]

THERE is a saying in Venezuela, *Sembrar el Petroleo*, which means "Sow the Petroleum." The idea behind this expression is that part of the oil, like seed corn, should be "planted" each year, so that a crop of other economic activities may be reaped to benefit the country. This is a sound and brilliant concept, for if properly implemented it strikes at the roots of how capital is formed and wealth is created.

To this maxim I would like to add a companion, *No Perdamos el Cliente*, or "Do Not Lose the Customer." The thought here is that the demand for the products of Venezuelan oil is determined by the decisions of distant and widely scattered buyers whose interests accordingly require cultivation. To serve the customer's needs calls for measures supporting low-cost production and promoting a climate of encouragement for productive enterprise. In the world of competition, the "cliente" has a free choice and is responsive only to the forces of attraction or repulsion.

These two principles epitomize the oil problem in Venezuela, whether viewed from the point of view of the Nation or that of the industry. Broadly conceived and properly combined, they offer the best means—perhaps the only means—for maximizing the role of Venezuelan oil in world trade and improving its effect upon the country's economy.

The Resource

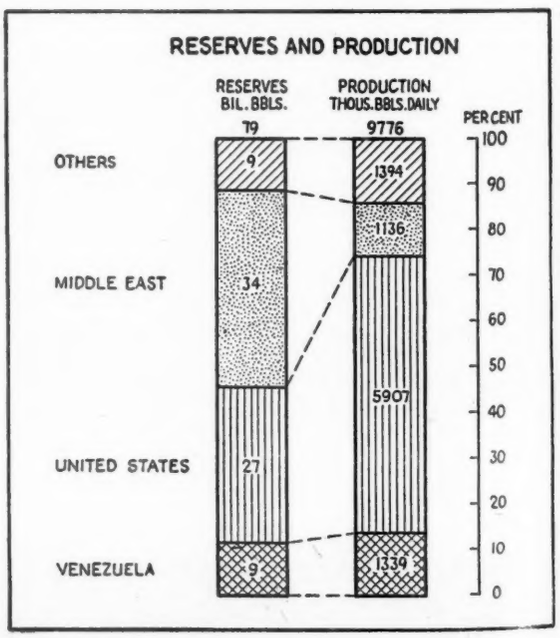
The petroleum resources of Venezuela are very great—sufficient to support a large oil activity into the next century. Production to date has been approximately 4.5 billion barrels and the presently proved reserve is of the order of 9 billion barrels. Thus about 13.5 billion barrels have been discovered. But much of the oil in Venezuela is still to be located. Most of the oil thus far found is in the Tertiary formations of the Maracaibo-Falcon and Orinoco basins. (See Fig. 1) The Cretaceous beds, which are known to underlie much of the oil territory, have scarcely been scratched by the drill and a third petroliferous basin, the Apure, is virtually unexplored. These considerations suggest that perhaps as much oil remains to be discovered as has been found. Studies on the volume of sediments also point to adequate unexplored reserves to support the maximum demands probable for some time to

1. This paper was first published by The Chase National Bank of the City of New York, of which the author is vice president.

[a]In the preparation of this paper, I have had the privilege of visiting the principal oil fields of Venezuela, and while in Caracas of discussing economic matters with a large number of leading Venezuelan officials, businessmen, and bankers as well as with officials of the operating oil companies. My indebtedness to these gentlemen for innumerable courtesies is very real; their thoughtfulness and cooperation have proved invaluable for this study and deep appreciation is felt. The data presented in Tables 1, 2, 3, 4, 8, 9, 10, 11, 12, and 13 and used as the basis for Figures 4, 6, 7, 8, 9, 10, 11, and 12 were compiled for the author by an independent accounting firm.

FIG. 1. Sketch map of Venezuela showing three basins productive of petroleum and the large area south of the Orinoco River in which great mineral wealth may be developed. The future of Venezuela may be influenced by flow of economic energy from oil to minerals.

FIG. 2. Oil reserves and production of Venezuela compared with those of other leading areas. Figures represent January 1, 1949 for reserves and the year 1948 for production.



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come. Several decades of search will undoubtedly be required to define the resource and a much longer period to exhaust it.

A proved reserve of 9 billion barrels compares with 27 billion barrels for the United States, 34 billion barrels for the Middle East, and 79 billion barrels for the world. (See Fig. 2.) The three areas combined represent about 89 per cent of the world's total, with Venezuela ranking third if the Middle East is considered as a unit.

The production of oil in Venezuela began 32 years ago. The rate of output on a daily basis reached 100,000 bbl in 1926 after 9 years of effort, attained 1,000,000 bbl 20 years later, and established an average of 1,339,000 bbl in 1948, representing in that year about 14 per cent of the world's total. (See Fig. 3.) In 1949, the level is not expected to exceed 1,200,000 bbl per day because of increased competition and a more temperate demand throughout the world.

Venezuelan crudes are of three types—heavy, light, and intermediate. The heavy, or low-gravity, crudes constitute about 60 per cent of the Nation's output and serve principally as a source of residual fuel oil. The light crudes, representing 27 per cent of the total, have characteristics resembling the oil produced in East and West Texas in the United States. The intermediate crudes are suitable for making asphalts, lubricating oils, and waxes and are roughly 13 per cent of the total. It is apparent, accordingly, that Venezuelan oil on the average yields a high percentage of fuel oil, causing the value of the crude to be closely related to world prices of a commodity largely used in marine bunkering and industrial plants in direct competition with coal, an alternate fuel. Residual fuel oil, as its name implies, is marginal amongst the series of oil products, almost always commands a unit price below that of crude oil, and must share the market with coal on a basis determined by the relative cheapness of the two rivals. Oil in Venezuela, therefore, not only must compete with oil from other sources but also with other fuels such as coal and natural gas, and in addition is directly dependent upon world levels of shipping and industrial activity.

The future rate of oil production in Venezuela will depend upon the pace of exploration and the growth of accessible markets. The rate of exploration will be influenced by the availability of concessions and the outlook for profitable recovery of the large investments involved in prospecting them. The withdrawal of new concessions from the market in 1946 has already led to a diversion of exploration efforts elsewhere, with an adverse bearing on future production. The availability of markets will depend upon the growth of world demands, the expansion of alternate sources of supply, and the cost levels in prospect for Venezuelan production.

Gas Reserves

No satisfactory data are available on natural gas reserves in Venezuela, but they are doubtless substantial. In the United States, 5 trillion cubic feet of natural gas have been found for each billion barrels of oil discovered, which suggests many trillions for Venezuela, although the predominance of heavy crudes in Venezuela indicates a much lower ratio. The subject is somewhat academic, however, since natural gas, unlike oil, cannot be exported to world markets and the economy of Venezuela is not as yet such as to afford important local outlets. The commercial development of natural gas, accordingly, must lag for a period. Natural gas is a by-product of oil in Venezuela and its values can be realized only slowly as it becomes commercially feasible to return a growing proportion to the producing oil sands suitable for its reception and to supply markets not yet developed

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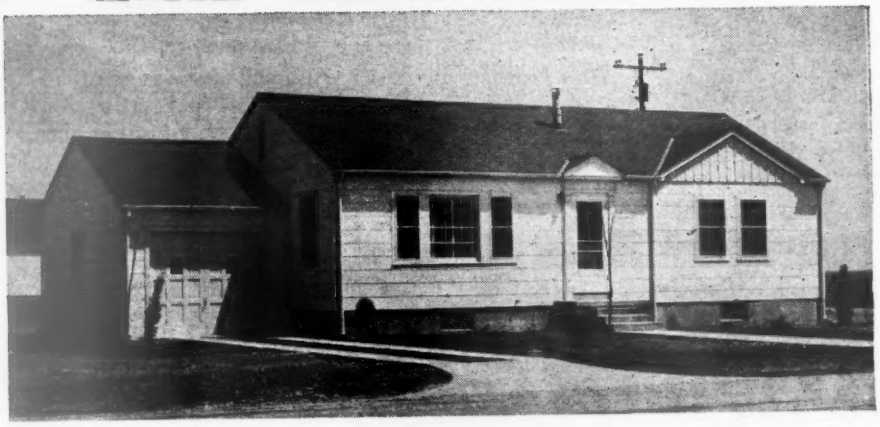

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or available.[2] Attempts to foreshorten the time will only result in raising oil-producing costs to the detriment of the oil market, or in reducing drastically the rate of oil production, which comes to the same effect. The oil-gas consumption relationships of the United States are not applicable to an economy which exports almost 99 per cent of its oil, and therefore Venezuela cannot fully realize upon its oil and gas simultaneously.

2. The establishment of synthesis plants for the conversion of natural gas into gasoline is handicapped by high construction costs and taxes, while the development of outlets for liquid petroleum gases is also retarded by cost factors and the absence of adequate markets. The establishment of carbon black manufacture, however, may become practicable after a period, when the supply available for this purpose in the United States becomes inadequate and causes part of the demand to look to other sources.

The Industry

The most fundamental aspect of the petroleum industry is its integrated structure—a pattern in which the functions of exploration, production, refining, transportation, and distribution are joined in an unbroken series. The petroleum industry in Venezuela, therefore, being of necessity largely confined to exploration and production, is only a part of a long "assembly line." Venezuela benefits from the whole series of activities, but cannot alter the links without impairing the strength of the chain, as the enforced development of local refining in excess of national requirements may reveal.[3]

In composition the petroleum industry of Venezuela is an aggregate of capital, technology, management, and labor. The capital funds employed have been derived almost entirely from foreign sources. The technology represents decades of research and applied science and while not generally regarded as capital is nevertheless one of its most useful forms. The management, itself a phase of technology, is largely of North American and British birth, although many high positions are now ably filled by Venezuelans. The work force is almost completely Venezuelan and responds well to specialized training.

In its form of organization, the industry consists of over 20 operating entities ranging from the large to the very small. Several of these units are affiliates, however, so that 12 corporate units or groups embrace nearly all of the oil activities. Most of the companies are parts of integrated units operating simultaneously in other countries and with established access to world markets. The corporate form of industry subdivision insures *competition*, which is a tireless and dynamic force driving the individual enterprises forward and keeping the aggregate on the economic beam. The corporate units stand at various stages of growth, from those highly advanced in accomplishment to those barely getting under way. (See Table 1.)

TABLE 1. Number of oil units operating in Venezuela with annual production (1) exceeding 1 million barrels and (2) under 1 million barrels, by years, 1939-1948

Year	Exceeding 1 million bbl	Under 1 million bbl	Total
1939	3	3	6
1940	4	4	8
1941	3	7	10
1942	3	8	11
1943	4	8	12
1944	5	6	11
1945	6	6	12
1946	7	7	14
1947	7	7	14
1948	8	6	14

Both in size and phase, the companies are susceptible in different degrees to the impact of economic and other forces.

3. In 1948 the volume of Venezuelan oil refined in the country was 119,000 bbl per day, or 8.9 per cent of the crude produced. The share locally refined is apt to increase because of governmental requirements. New refineries are in various stages of construction on the Paraguana Peninsula and near Puerto La Cruz, costing several hundred million dollars in the aggregate. The outcome of these developments is difficult to foresee because the facilities are extremely high cost and crude oil can find a more ready outlet in world markets than can petroleum products.

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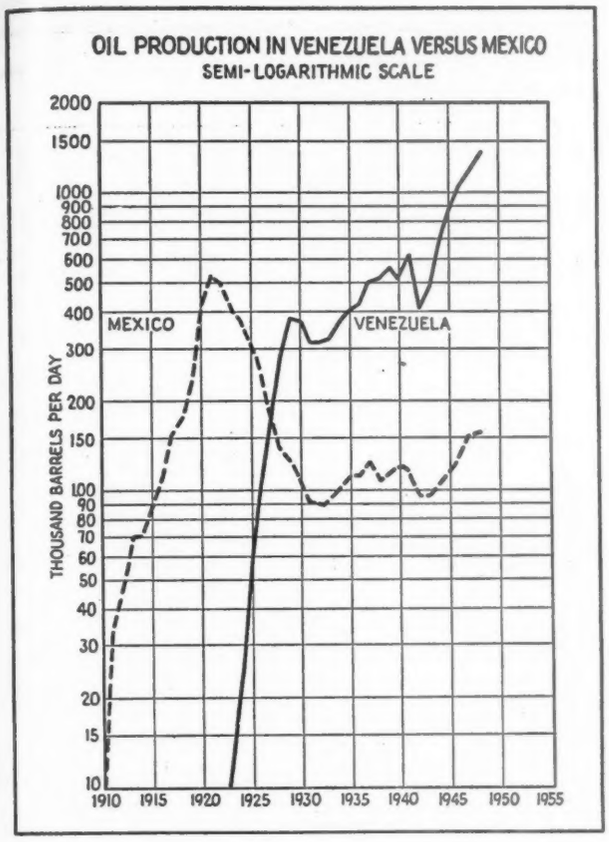

FIG. 3. Trend of crude oil production in Venezuela compared with Mexico, by years, 1910-1948. The early rates of growth in the two countries were almost the same, but whereas Mexico declined precipitously from its peak of 1921, Venezuela continued its growth from a temporary peak in 1929 and accelerated in the period, 1943-1948.

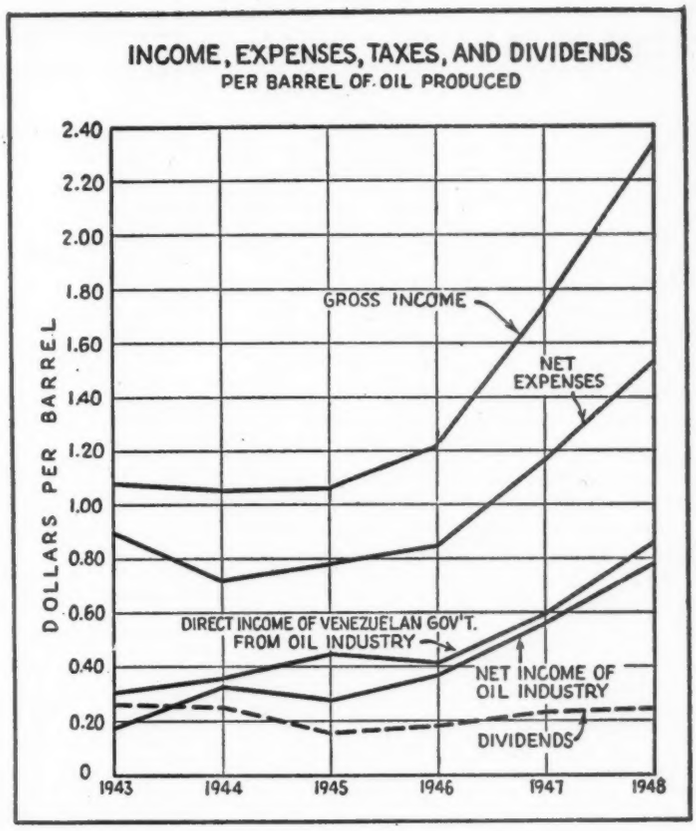

FIG. 4. Income, expenses, taxes, and dividends per barrel of oil produced, Venezuelan oil industry, by years, 1943-1948. For data see Tables 2 and 3.

In the aggregate, the Venezuelan oil companies have invested over 2 billion dollars in Venezuelan oil. Capital expenditures by the industry in the past six years alone totalled 1.28 billion dollars. The borrowed and invested capital engaged at the end of 1948 amounted to 1.36 billion dollars. The initial capital was derived almost exclusively from corporate and investor savings outside the country; and for individual enterprises during their formative periods this source continues paramount. In respect to the more recent investments of the established companies, the capital has been generated to a substantial degree from the operations themselves but obtained in an ultimate sense from the consumers who used the oil. Consequently, the entire development of the industry has taken place with virtually no risk of Venezuelan capital.

The Venezuelan oil industry reported substantial earnings for the past few years, particularly in 1947 and 1948, when demand was rapidly expanding and prices were rising as a result of the stimulus of the war and the resulting inflation. The profits, however, were not uniform, being confined to relatively few long established companies whose volume of production was large, with the later entrants still revealing losses.[4] Moreover, the reported net income was not fully available as "profit" since over half of it was reinvested in the business. Besides, the amounts classified as net income were expressed in monetary units of declining purchasing power and hence are not strictly comparable on a year-to-year basis. "Profits" of oil companies in the United States displayed similar distortions[5] and their course closely paralleled those in Venezuela.

In a period of rising prices, net income, the technical term for profit, must expand to help cover rising costs of replacing and expanding crude oil reserves and plant facilities. Under these conditions an abnormal share of the net income has to be used for capital expenditures and therefore net income ceases to be a true measure of profit. Established accounting procedure does not allow for the distortions brought about by inflation, but these departures from normal are universally present in corporate accounts and must be dealt with *de facto*, if not *de computare*.

The trend of these relationships is given for 12 Venezuelan oil companies for the years 1943 to 1948 in Table 2. For the six-year period, the Venezuelan oil industry showed "accounting profits" of 971 million dollars but 527 millions, or 54 per cent, were reinvested in the business and therefore were used for capital formation instead of dividend payments. It will be observed (see also Table 12) that as "profits" rose the amount and proportion reinvested likewise increased. If the "accounting profits" are recomputed in terms of prewar dollars, it is

4. In 1946 barely half of the operating units had attained a profitable status.
5. See testimony of J. E. Pogue on December 9, 1948, before the Subcommittee on Business Profits of the Congress of the United States, as summarized in a pamphlet entitled *The Function of "Profits" in the Petroleum Industry*, published by the Chase National Bank in December, 1948.

found that the 971 millions shrink to 568 millions, a contraction of 403 millions, or 42 per cent, representing the decline in purchasing power caused by price inflation.

The income figures per barrel of crude oil produced are also presented in Table 2 and expressed graphically in Fig. 4. The gross realization in 1943-1948 ranged from a low of $1.05 per barrel to a high of $2.33 per barrel; the net expenses, or costs, from 72 cents to $1.54; the net income from 18 cents to 79 cents; dividends, from 16 cents to 24 cents; and net income reinvested, from a minus figure to 55 cents. By way of comparison, total direct taxes ranged from a low of 31 cents per barrel in 1943 to a high of 86 cents per barrel in 1948, and averaged 55 cents per barrel over the six years.

The relation of direct taxes to selected items of income is shown in Table 3 and Fig. 4. Taxes have averaged 52 per cent of net expenses, and 117 per cent of net income. These figures are relatively high and may place Venezuelan crude oil at a competitive disadvantage in world markets.

It is customary to compute the return on capital as a measure of the effectiveness of its use and as a criterion of its "profitability." Such a calculation for the 12 Venezuelan oil companies is presented in Table 4, but it should be pointed out that the computation is mathematically incorrect because net income is expressed in monetary units of different purchasing power from those used to measure the amounts of capital employed. In other words, a ratio is struck between two series of different specifications, which is not logically permissible. Dividends, it may be added, constitute a more realistic measure of "profits" than net income affords, although there is the same fallacy present in an attempt to relate dividends to invested capital.

The most effective criterion of "profits" is their adequacy for purposes of capital formation. In fact, they are bound to fluctuate in terms of the supply of, and demand for, capital formation, which is a part of the familiar law of supply and demand. Since the need for capital formation in the Venezuelan petroleum industry will be less in 1949 than in 1948, the demand for oil being less insistent, the supply of funds generated for this purpose can be smaller and profits accordingly may be expected to show a decline.

Perhaps the most dramatic feature of the petroleum industry in Venezuela is employee relations. By virtue of the Labor Law, collective contracts, and

TABLE 2. Trend of net income of twelve Venezuelan oil companies, by years 1943-1948 (in millions of dollars).

	1943	1944	1945	1946	1947	1948	Total for period
Gross income	195	270	343	473	755	1,112	3,148
Net expenses	163	186	254	330	509	735	2,177
Net income	32	84	89	143	246	377	971
Dividends	46	62	50	69	103	114	444
Net income reinvested	—14	22	39	74	143	263	527
(In dollars per barrel produced†)							
Gross income	1.08	1.05	1.06	1.22	1.74	2.33	1.53
Net expenses	0.90	0.72	0.78	0.85	1.17	1.54	1.06
Net income	0.18	0.33	0.28	0.37	0.57	0.79	0.47
Dividends	0.26	0.25	0.16	0.18	0.23	0.24	0.22
Net income reinvested	—0.08	0.08	0.12	0.19	0.34	0.55	0.25
(Adjusted to dollars of prewar purchasing power‡)							
Price index (1935-1939=100)	128	129	131	150	188	205	...
Net income, adj. million dollars	25	65	68	95	131	184	568

†Computed by dividing the dollar figures by the barrels of crude oil produced less royalty in kind to the Venezuelan Government.

‡Computed by dividing reported net income in dollars by the U. S. Bureau of Labor Statistics Index of Wholesale Prices of All Commodities on the basis of 1935-1939=100.

TABLE 3. Direct oil taxes per barrel of crude oil produced compared with various income items. Data based upon twelve Venezuelan oil companies, by years, 1943-1948

	1943	1944	1945	1946	1947	1948	Total for period
Crude oil produced†—million bbl	179	257	323	388	434	477	2,058
Total direct taxes‡—million dollars	55	94	146	163	262	411	1,131
Taxes per barrel—$	0.31	0.37	0.45	0.42	0.60	0.86	0.55
Net expenses per bbl (dollars)	0.90	0.72	0.78	0.85	1.17	1.54	1.06
Net income per bbl (dollars)	0.18	0.33	0.28	0.37	0.57	0.79	0.47
Taxes in per cent of net expenses	34	51	58	49	51	56	52
Taxes in per cent of net income	172	112	161	114	105	109	117

†Excludes government royalty taken in kind.
‡See Table 10.

TABLE 4. Net income and dividends, actual and in per cent of the capital employed in the business, twelve Venezuelan oil companies, by years, 1943-1948 (in millions of dollars).

	1943	1944	1945	1946	1947	1948	Average for period
Capital employed in the business	477	541	646	808	717	1,359	758
Net income ("profit")	32	84	89	143	246	377	162
Dividends	46	62	50	69	103	114	74
Ratio of net income to capital employed (Per cent)	6.7	15.5	13.8	17.7	34.3	27.7	21.4
Ratio of dividends to capital employed (Per cent)	9.6	11.5	7.7	8.5	14.4	8.4	9.8

enlightened management, the pattern in all companies is virtually the same. About 58,000 persons are engaged in the business, of whom 93 per cent are Venezuelans, representing about 1.3 per cent of the population of about 4.4 millions. Employment is relatively stable and does not suffer from seasonal lay-offs. Normally the workers are paid for every day of the year which is divided as follows: normal work days, 280; Sundays, 52; national holidays, 9; and vacations, 24. The work week is 48 hours for day workers and 42 hours for night workers; for office workers, 44 and 40 hours respectively.

Labor costs, including basic wage, extra compensation, indirect pay, and attendant benefits, are among the highest in the world, amounting for the first half of 1948 to $15.13 per

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man per work day. The worker is well cared for and enjoys a wide range of advantages such as overtime, vacation pay, travel time to and from work, profit-sharing, medical attention, housing allowance or maintenance, educational facilities, hospitalization, commissaries, and many others. The worker camps in the oil fields are model villages that would do credit to any community. The costs per man to the companies is shown in Table 5.

This tabulation indicates that total daily take-home pay is the equivalent of $9.84; indirect pay amounts to $1.12; and indirect benefits aggregate $4.17—a total of $15.13 per working day. These figures are regarded as typical of the industry in general. In addition, several of the companies incurred other expenses, as outlined at the bottom of Table 5, which amounted to 80 cents per worker, all computations based on 280 working days in the year but including the cost of the remaining days for which the worker is paid but does not work. These results indicate that the average worker cost the latter group $4460 per year.

The modern labor movement in Venezuela may be said to date from the passage of the Labor Law of 1936, following the death of Gomez. This law was a forward piece of labor legislation establishing liberal and modern standards for labor practices and placing responsibility for administration under the Ministry of Labor. At the time of its passage, it was far in advance of the industrial development of the country and the social thinking of the majority of its people. It included special requirements affecting only the petroleum industry, including modern sanitary housing for workers in permanent field camps, the provision of primary education for workers' children, and complete medical care for all employees. The law also provided for the formation of syndicates or unions, and subjected them to certain obligations and controls including a detailed accounting of receipts and disbursements and a prohibition of affiliation with any political party, domestic or foreign.

TABLE 5. Daily costs per worker in the oil industry in Venezuela (per working day).

	Bolivars	Dollars†
Basic wage	17.98	5.82
Bonuses, rest days, overtime, travel time, vacation pay, holiday pay, profit sharing	12.40	4.02
Service and severance indemnities, illness and accident expense, medical benefits, housing allowance, and time off	3.47	1.12
Travel allowance, housing maintenance, tuition and scholarships, employee training, school expenses, recreation expenses, hospital and dispensary expenses, commissaries, etc	12.89	4.17
Total labor cost per man per work day	46.74	15.13
Additional costs not applicable to entire industry. (Retirement plans, death benefits, group insurance, thrift plans, and retirement allowances)	2.48	0.80
Grand total	49.22	15.93

†Conversion factor: 3.09 bolivars=$1.00. This exchange rate reflects the cost of bolivars to the oil companies.

This law undoubtedly set the pace for later developments. Local syndicates or unions were formed in great numbers. In 1946 the syndicates, some 40 in number, were combined in an Oil Workers' Federation, which negotiated a contract with the oil companies which had the effect of raising the cost of the average worker by about 50 per cent. Upon the expiration of this contract, a new one was signed in February of 1948, with a duration of three years, but subject to reopening at the end of two years, which increased payroll costs an additional 20 per cent.

It is apparent that the oil worker, supported by liberal labor laws and a strong labor organization, has directly benefited tremendously from oil developments. These advantages are reflected in basic rates of pay, but even more so in related benefits in welfare. The results are especially impressive to anyone visiting an oil camp. The outcome has not been forced on a reluctant industry, for management has promoted the social advances of the worker and apparently has regarded the requirements of the law and collective bargaining as a platform on which to build an employee relations program which stands as further testimony to the constructiveness of enlightened enterprise. And yet some queries obtrude: the cost effect upon the competitive position of Venezuelan oil in world markets; the consequences to the worker himself of advantages which have come too quickly for balanced absorption; and whether the time has not arrived for local citizens to conduct many of the service operations which have thus far, and in the formative stages perhaps appropriately, fallen to the responsibility of the petroleum industry.

* * *

(Part 2 of "Oil in Venezuela" will be published in an early issue.)

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2—FST Splitter Condensers

2—Twin G-Fin Section Splitter Feed Exchangers

1—CSU Splitter Reboiler

2—FGT Deethanizer Condensers

2—Twin G-Fin Section Deethanizer Feed Exchangers

1—CSU Deethanizer Reboiler

2—FST Depropanizer Condensers

3—Twin G-Fin Section Depropanizer Feed Exchangers

1—CSU Depropanizer Reboiler

2—FGT Debutanizer Condensers

2—Twin G-Fin Section Debutanizer Feed Exchangers

1—CSU Debutanizer Reboiler

2—FST Dependanizer Condensers

2—Twin G-Fin Section Dependanizer Feed Exchangers

1—CSU Dependanizer Reboiler

3—FGT Primary Still Condensers

3—FGT Main Still Condensers

2—Twin G-Fin Section Propane Coolers

1—Twin G-Fin Section Propane Dehydration Regeneration Gas Reheater

1—Twin G-Fin Section Mixed Butane Cooler

3—Twin G-Fin Section Debutanizer Bottoms Coolers

2—Twin G-Fin Section Isopentane Final Coolers

3—Twin G-Fin Section Gasoline Coolers

4—FST Rich Oil Preheaters

3—Twin Bare Pipe Section Regeneration Gas Coolers

2—Twin Bare Pipe Section Regeneration Gas Heaters

2—Twin Bare Pipe Section Reabsorber Intercoolers

8—FST Main Oil Exchangers

12—FST Compressor Lube Oil Coolers

8—FST Compressor Jacket Water Exchangers

3—FST Engine Jacket Water Coolers

1—H Bentube Feedwater Evaporator

1—F Drainer

1—K Level Controller

3—Twin Bare Pipe Section Steam Condensate Exchangers

2—Twin Bare Pipe Section Condensate Coolers

GR-228

PETROLEUM PROFILE

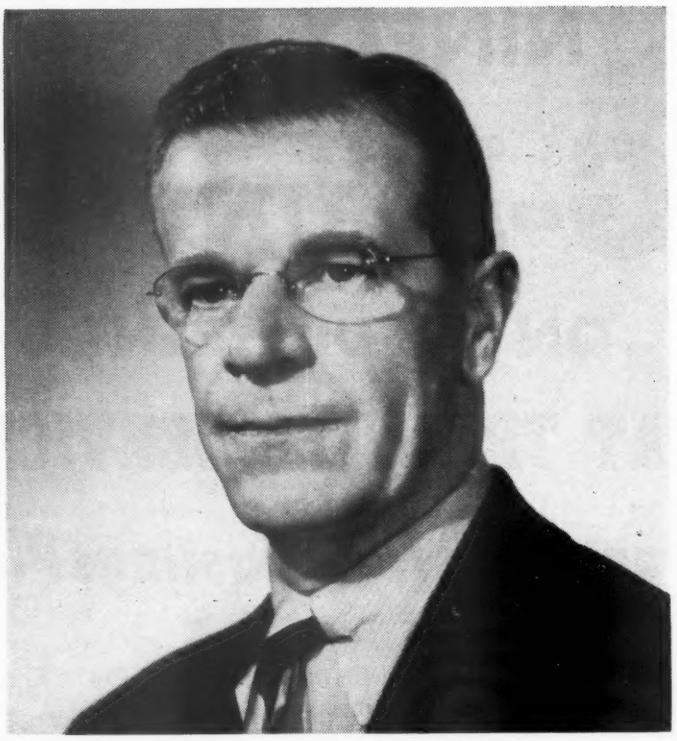
F. S. CLULOW, Shell Oil director and vice president in charge of manufacturing, has been connected with manufacturing through most of his 29 years in the oil business. He has worked in refineries in many parts of the world and has seen revolutionary developments in refining technology.

Born in Leeds, in Yorkshire, England, this lean, distinguished-looking oil veteran says that he just happened into the petroleum industry: "When I graduated from school, there were not many opportunities for chemists." A study of his college curriculum reveals that he was particularly well qualified for a petroleum career, however. He majored in chemistry at the Royal College of Science in London and received a B. Sc. degree in 1919. He did post-graduate work in petroleum technology, including research on the structure of greases. Geology was his second subject.

His college career was interrupted by World War I, in which he served as a lieutenant in a machine gun company. His tendency to understatement is illustrated by his account of his military experiences: "Nothing unusual about them. Ten months in France and 16 months in a hospital. Had my knee bashed in."

He joined the Shell group of companies on September 1, 1920, as a chemist at the Shellhaven refinery in England. In 1922, he was transferred to Suez, where he headed Shell's laboratory and treating facilities. Four years later he hopped half way around the world to Sarawak, Borneo. Here he was assistant manager and then manager of the company's 20,000 to 25,000 bbl refinery at Miri.

After 10 years' service with various companies of the Shell Group, he came to Shell Oil's Martinez, California, refinery in 1930 as manager of the distilling department. Later that year he was promoted to assistant superintendent. He was loaned to Shell Oil of Canada in 1933 to take charge of putting their new Montreal refinery on stream, and when this job was completed the following year, became manager of the refinery Shell then had at East Chicago, Indiana. In 1938, after serving for a brief period as manager of manufacturing in Shell's San Francisco office, he was appointed vice president in charge of all the company's West Coast manufacturing operations. He was 42 years old.



F. S. CLULOW

War was about to engulf the world, and during his subsequent years in office, Shell refining facilities were to expand at a record pace. A catalytic cracking plant, first unit of its kind started after Pearl Harbor to be completed in the United States, was dedicated in 1943 at Shell's Wilmington-Dominguez refinery. Another new plant erected at Wilmington early in the war was the first plant west of the Rockies to make toluene from petroleum. Hydrogenation and alkylation plants and many other new units important to the war effort were also put in operation in California during this period.

Awards to Shell refineries by the armed forces and the National Safety Council also distinguished Clulow's 10-year vice presidency on the West Coast. The Army-Navy "E" was awarded to the Martinez refinery in 1944. In 1945, the Martinez and Wilmington-Dominguez refineries were first in the country to receive the National Safety Council's "Award of Honor for Distinguished Service to Safety." Since then, each of these refineries has received two similar awards.

Clulow moved from San Francisco to the New York head office in January, 1949, to assume over-all responsibility for Shell manufacturing activities from coast-to-coast.

Asked to comment on his almost three decades of service in the petroleum industry, he said, "It's been interesting all the way." And you know he means it. Reserved, dignified, and softspoken, he is completely sincere and unassuming.

Outside business hours, he is an ardent golfer and fisherman. He used to play San Francisco's hilly Presidio course in the 80's, but says, "If I can break 100 now, I think I'm lucky." He likes both fresh water and salt water fishing, but is particularly enthusiastic when he talks about trout streams in the Sierras and Oregon.

He has three sons, Dennis, 25, Peter, 24, and Jeremy, 15.

Currently he is looking for a place in the country near New York where he can relax with his family after work, away from the hubbub of Manhattan and the R.C.A. Building, where he has his office. ***

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WICKES

2-DRUM STEAM GENERATORS

The two engineers's drawings shown here are typical of the Wickes two-drum steam generators being installed in industries and public buildings of all kinds. Wickes Boilers are operating at an extremely high degree of efficiency and owners' records show very modest maintenance costs. Capacities of Wickes Boilers are up to 250,000 lb. steam per hour, pressures up to 850 psi. All types of multiple drum boilers, adaptable to any type firing. Contact your nearest Wickes representative or write our engineers in Saginaw.

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NEWS

Duty-Free Oil Illegal

Officials in Washington have stated that an agreement between U. S. and Canada permitting the entry of duty-free crude from the Alberta fields could not be made under the Reciprocal Trade Act. The act permits the President to reduce import duties, but it does not empower him to transfer items from the dutiable to the free lists, it was pointed out.

The purpose of the proposed agreement, it was reported, was to export duty-free crude oil into the United States from Canada, and in return take a corresponding value in refined products, duty-free.

Whether the idea got further than a suggestion is not known, but the U.S. did call Canadian authorities' attention to the limitations of the Reciprocal Trade Act.

Imperial Oil, Ltd. is setting up a subsidiary in the United States, which would take the crude over as it crossed the border, some of it possibly in bond for refining and re-export in the form of products, so it is assumed the plan has been dropped.

Universal to Build Plant

Universal Oil Products Company has purchased a tract of land in excess of 600 acres between Shreveport and Mooringsport, Louisiana, on the Kansas City Southern Railroad, where Universal plans to construct a plant for manufacture of specialty products.

Actual construction of the manufacturing plant will depend on one or two major factors on which decisions are pending, but if those decisions are favorable then the company will start construction on the first unit as rapidly as possible.

Reduces Heavy Fuel Prices

Reduction of heavy fuel oil prices by 35 cents a barrel for low gravity crude have been announced by Standard Oil Company of California.

The fuel oils affected are generally used by railroads, steamships, and industry. The reductions on purchased crude range from 3 cents on 25 gravity oil to 35 cents for 14 gravity and under.

Union Oil Company has also reduced the price of heavy fuel oil by 35 cents per barrel. The company stated that its posted price accurately reflects fuel oil market conditions on the West Coast. With heavy fuel oil in long supply, a considerable volume has been moving at under the previously posted prices.

Australia May Buy Russian Oil

Electronic Industries, Ltd., of Melbourne, Australia has made application to import Russian oil. From indications in Canberra, where government men are examining the application, small Russian petrol shipments will not be questioned. Should a larger quantity be involved, however, Australia will consult the British treasury.

Acceptance of the Russian petrol may deprive other Sterling countries of supplies, some Australian officials think. A. G. Warner, managing director, Electronic Industries, stated that Russian trade officials had offered to supply an unlimited quantity of petrol to Australia. Russia is prepared to accept payment in sterling on Australian wool or wheat, Warner added.

Standard Wins Award For Annual Report

In the final ratings of an independent board of judges for the Financial World Annual Survey, Standard Oil Company (New Jersey), was judged as having the best annual report for the second consecutive year of the petroleum industry. The bronze "Oscar of Industry" trophy will be presented to Eugene Holman, president of Standard Oil Company (New Jersey), at the Annual Awards Banquet in the Grand Ballroom of the Hotel Statler, in New York, on October 31, 1949.

In the "petroleum industry" category, Gulf Oil Corporation, Pittsburgh, Pennsylvania, was runner-up for top honors, while Standard Oil Company (Indiana), Chicago, Illinois, took third place.

Communists Control Shanghai Oil Supplies

Oil supplies in Shanghai have been placed in the hands of the Chinese Communists, who have already ordered all oil companies, including foreign concerns, to register their stock. Although the oil companies still hold title to their supplies, if they want to sell any they have to get the approval of the Communist oil control commission.

Refunds Carbon-Black Tax

Texas has been ordered by District Judge Jack Roberts to refund $265,000 in carbon-black taxes to Phillips Chemical Company. The carbon-black tax applies to the product of natural gas, the court ruled, and Phillips protested payment of the taxes on the basis that the company process used oil instead of natural gas for the production of carbon black.

California Faces Over-Supply Problem

California's oil industry faces a serious problem because of the continuing over-production of crude oil. An unbalanced condition exists between supply and demand with critical implications for the future of the industry in this state.

As a result of over-production, inventories in District 5, covering the Pacific Coast area, increased at the rate of 35,000 bbl daily in the first quarter of this year, 135,000 bbl daily in the second quarter, and 144,000 bbl daily in July and August. This has resulted in an unsold accumulation of more than 24,000,000 bbl since the first of the year, placing an unwieldy stock burden on both large and small oil companies, according to a release put out by Standard of California.

The over-supply has been brought about by a variety of causes. Accelerated development to meet post-war demands created a production level of more than 900,000 bbl daily. This year, reduced export and military requirements, decreased maritime activity, railroad dieselization, large imports of natural gas and other factors have curtailed demand. California has no petroleum conservation law despite the fact that it is the second largest producing state in the nation. In other important producing states, such as Texas, production is controlled by law and well output has been cut back.

IPAA Predicts Imports Will Increase

The Independent Petroleum Association of America predicts that crude oil imports will increase, rather than show any decline, during the last quarter of the year.

In a report to the association's president, Fred W. Shield of San Antonio, Texas, Russell B. Brown, general counsel, urged that some strategy for new attempts to curb oil imports should be worked out. The bill of Sen. Elmer Thomas of Oklahoma, providing a percentage quota on imports, was defeated 41 to 40 recently by the Senate. IPAA had supported the measure. This vote, Brown wrote, "should not discourage our efforts which, if pursued fearlessly and fairly, will succeed."

Brown charged that major oil companies that import petroleum had influenced State Department policies. "Once Congress becomes fully aware of the manner through which these companies are manipulating government departments, Congress will act," Brown stated.

Standard of California Has Deepest Oil Producer

Standard Oil Company of California announced completion of the world's deepest oil well, Mushrush No. 5, near Wasco, Kern County, California.

The well flowed at the rate of 375 bbl daily of 40 gravity oil and 1,000,000 cu ft of gas from a producing intreval of from 15,250 to 15,530 ft in the Eocene. The total producing depth is 15,866 ft, about 1000 ft deeper than any other recorded production. The well proves a new zone in Wasco field, which currently produces from about 13,000 ft. It was begun in March on a hole previously bottomed at 13,130 ft.

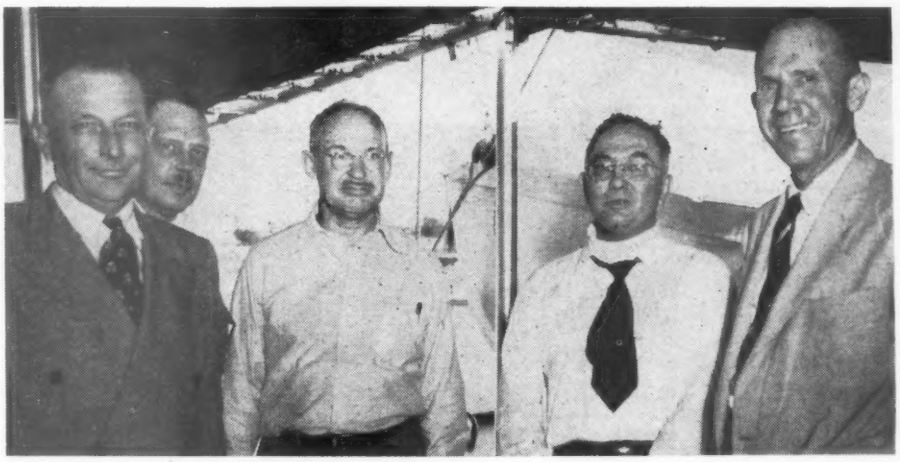
Higher Prorations Set

Increased oil allowables in Texas, Louisiana, Kansas, and Oklahoma are bringing crude oil production back up to the rate set earlier in the year.

An average allowable of 2,135,238 bbl of crude oil per day for October has been ordered by the Texas Railroad Commission. This represents a 32,044 bbl daily increase over the September output of crude oil.

Louisiana's daily crude oil production for October is 557,000 bbl, a 48,000-bbl increase. Kansas' proration was set at 275,000 bbl daily, up 15,000 from September. The Oklahoma oil production allowable for this month was set at 410,000 bbl daily, an increase of 50,000 bbl over the September rate.

Recent visitors aboard the Aminol at Orange, Texas, included: Floyd Miller, engineer, American Independent Oil Company; W. L. Hankins, purchasing agent, American Independent; P. W. Hill, Signal Oil and Gas Company, N. P. Isenberger, vice president, American Independent; and G. L. Young, vice president and director, Signal Oil and Gas.



Hold First Fall Meeting

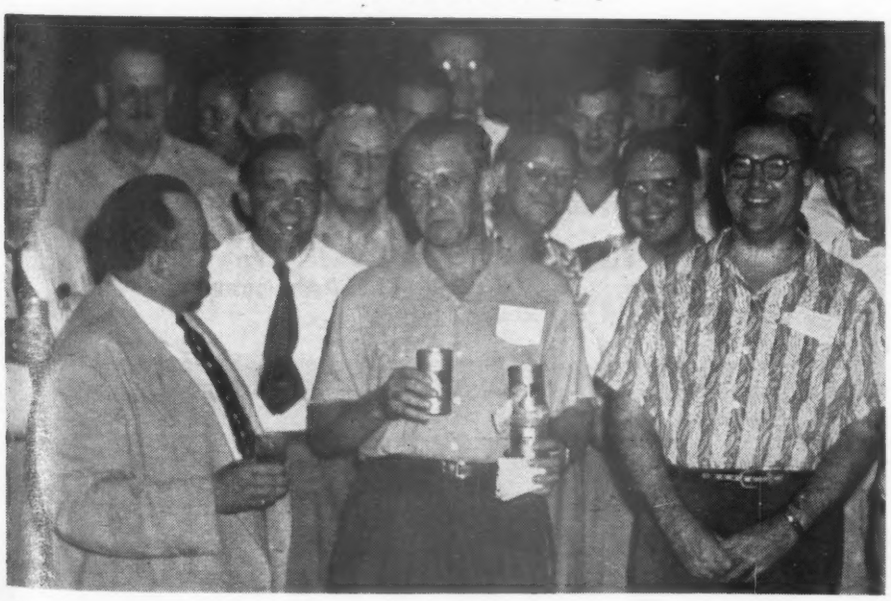
The first meeting of the Los Angeles Nomads since June was held at the Jonathan Club, September 14. Two reels of the U. S. Navy Film covering the Navy Project, Pet 4 were shown. The films concerned the search for oil in Northern Alaska. This search has been under way for some time and will continue at least into 1953.

Ben E. Mater of Baker Oil Tools Inc. was welcomed as a new member.

Five new requests for membership were offered at the meeting. These are: Onos Lindsay, Eastman Oil Well Survey Company; Frederick B. Williams, Baroid Sales Division; D. J. Bergeron, Baash-Ross Tool; Daniel M. Bernt, Pacific Perforating; Art Moore, Oil Base Inc.

Foreign guests at the meeting were: Ralph H. Connor who is returning here after serving several contracts with the Basrah Petroleum Company, Tripoli, Lebanon; Zell W. McCoy who has spent the last 10 years with Texas Petroleum, Bogota, Colombia; C. B. Ridgeway, Arabian-American Oil, Saudi Arabia; T. A. Connor, Iraq Petroleum, Iraq, home on sick leave recovering from an accident in the oil fields; Algar L. Ridgeway, Standard Oil; W. K. Kirby, field manager for Canso Azul, Lima, Peru; William Ohlandt, Jr., Texas Petroleum, Caracas, Venezuela, who has recently completed two years with Arabian American Oil; J. G. Woods, Richmond Exploration, Maracaibo, Venezuela; John L. Everett, Méne Grande Oil, Venezuela; G. H. Atkins of the Creole Petroleum Corporation in the Eastern Venezuelan area; C. H. Strickland, Iraq Petroleum Company, Iraq, who is here on special home leave; C. M. Williams, Iraq Petroleum, Iraq; C. R. Devine, Basrah Petroleum, Iraq, who was formerly with Drilexco in Brazil; Wladimir Ziloff, Pantapec Oil, Venezuela, formerly of the French Institut du Petrola, now assigned in eastern Venezuela.

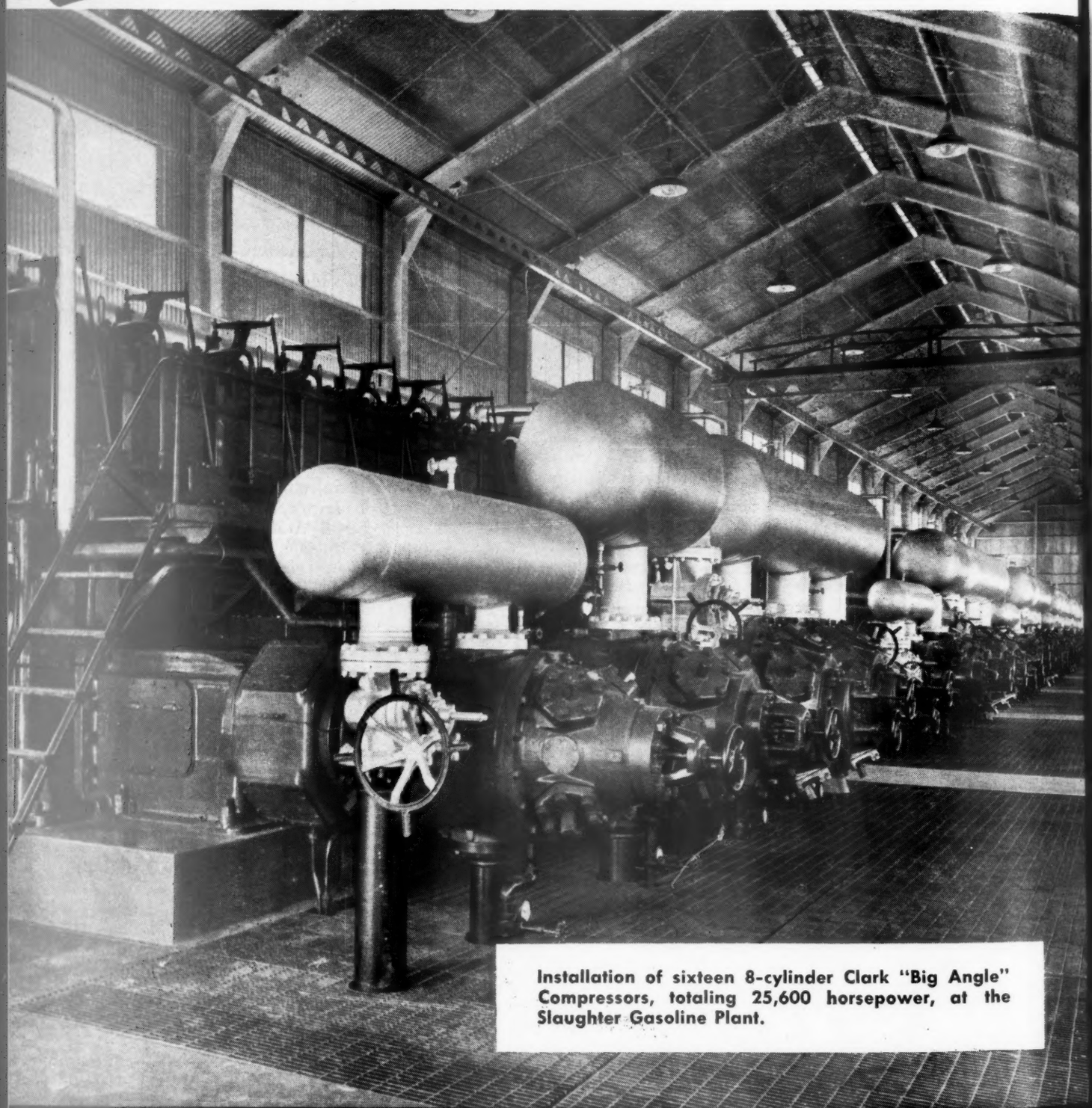
These Dallas Nomads recently attended a meeting in Fort Worth, Texas. They are: C. J. Berlin, Baker Oil Tools; H. D. Powell, Mid-Continent Supply Company, pipe department; H. N. Cosgrove, secretary, National Board of Regents; A. J. Olsen, Continental Supply Company; Ed Calnon, guest; Richard Fast, Stanolind Oil and Gas Company; R. J. Beaur, Gardener-Denver Pump Company; Charles Yeager, Texas and Pacific Coal Company.



Need Petroleum Engineers

A call for men or women with experience in petroleum engineering has been made by the Air Force. The National Petroleum Council, speaking for the Strategic Vulnerability Branch of the Directorate of Intelligence, states that positions in this and related fields pay from $3,727.20 to $7,432.20 a year.

Again! "BIG ANGLES" AI

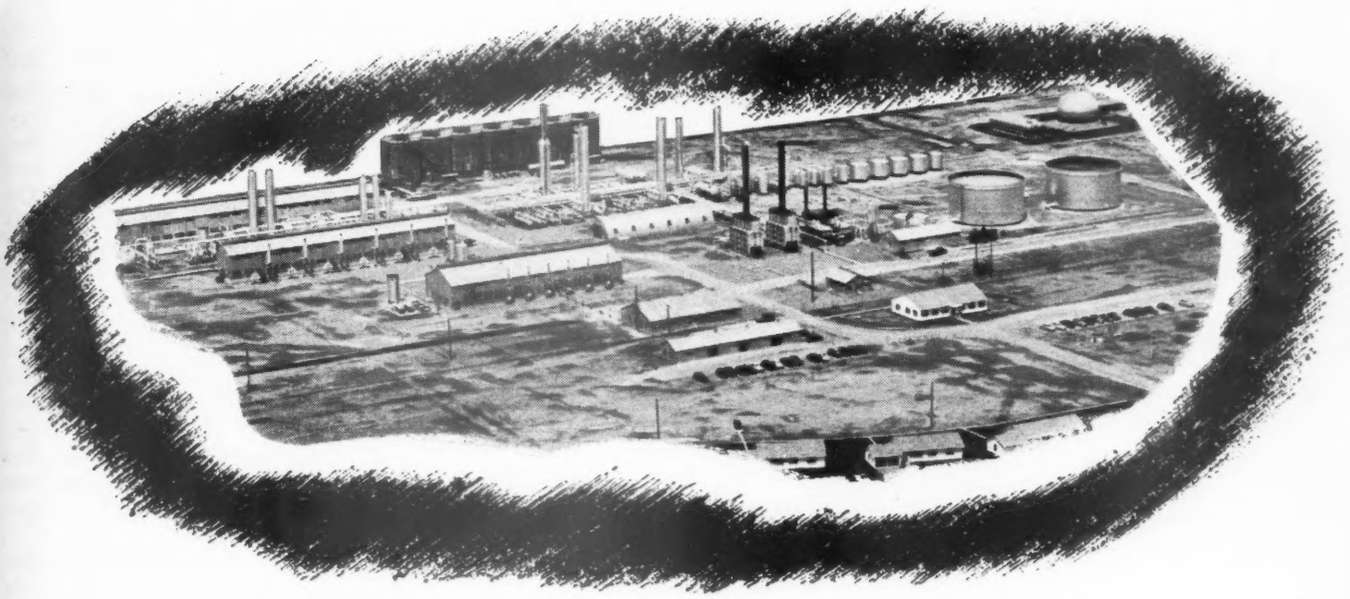


Installation of sixteen 8-cylinder Clark "Big Angle" Compressors, totaling 25,600 horsepower, at the Slaughter Gasoline Plant.

CLARK "BIG ANGLE" C

ONE OF THE DRESSER INDUSTRIES

AID CONSERVATION



25,600 CLARK "BIG ANGLE" HORSEPOWER SERVES MAJOR CONSERVATION PROJECT AT SLAUGHTER POOL, TEXAS

At the new Slaughter Pool Natural Gasoline and Gas Conservation plant*, Clark "Big Angle" Compressors are a vital part of a major conservation project. These units make up the largest compressor installation in the natural gasoline industry.

The plant is designed for the production of natural gasoline, butane and propane—from gas formerly burned off as flare gas. In addition, the dry residue gas is sold to a gas pipe line company for use as fuel.

Sixteen 8-cylinder "Big Angles", rated at 1600 BHP each, are used to compress about 90,000,000 cubic feet of "casinghead" gas per day from 13.2 psia to 713 psia in three stages—at a plant elevation of 3,000 feet.

The Clark "Big Angle" Compressors are aiding conservation by meeting the Oil Industry's needs for high-powered, heavy-duty, Gas-Engine-Driven Units. The BA has a wide operating range and is the most accessible for servicing of any compressor . . . saves money on both maintenance and installation costs.

WRITE FOR BOOKLET

For complete description, dimensional drawings and other data on "Big Angle" Compressors, send for Bulletin B-A.

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*THE SLAUGHTER PLANT IS OWNED BY: Stanolind Oil and Gas Company; The Texas Company; Honolulu Oil Corporation; Magnolia Petroleum Company; The Devonian Company; The Atlantic Refining Company; Saltmount Oil Company; Mid-Continent Petroleum Corporation.

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Those distinguishing lock-seam spirals make Naylor Pipe stand out anywhere. This characteristic Naylor construction provides performance as distinctive as its appearance. Though light in weight, Naylor Pipe is stronger and safer than ordinary light-weight pipe. The Lockseam Spiralweld assures additional collapse strength and serves as a continuous expansion joint to cushion shock loads, stresses and strains. Naylor Pipe is easy to handle, easy to install and saves material, labor and money right down the line. Sizes from 4″ to 30″ in diameter with all types of fittings, connections and fabrications.

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Mid-Continent Supply Company
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Exclusive distributors in
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Reports Lower Production

Gulf Oil Corporation told stockholders in a semi-annual report that it produced 12 per cent less crude oil in the United States for the first six months of 1949 than it did for the same period last year.

Production in Venezuela for the period was down also, the company stated.

Award Fellowships

Seven leading oil companies have awarded fellowships and scholarships to advanced chemistry and geology students for the 1949-50 long session at the University of Texas. They are: Stanolind Oil Company, Humble Oil and Refining Company, Shell Oil Company, Magnolia Petroleum Company, Monsanto Chemical Company, Pan American Refining Company, and E. I. duPont de Nemours.

Report Service Opens Office

Dan Payne's Louisiana Oil Reporting Service and Dan Payne's Louisiana Oil Directory has opened an office in Dallas, Texas. L. A. Ross has been named associate editor and manager of the Dallas branch.

Oil activity in Louisiana and Mississippi is covered by the company's report, which is issued on Wednesdays and Saturdays. Ross has been with the firm for 8 of its 10 years' existence.

Barnsdall and Ogden Merge

Barnsdall Oil Company and Ogden Corporation have reached an agreement for merger of the two companies. The new concern wil be known as Barnsdall Oil Company, with the same officers and directors as the present Barnsdall Oil Company. Common stockholders of both Barnsdall and Ogden, which was formerly a public utilities holding company, will have the right to exchange their holdings for common shares of the new company.

PETROLEUM SERVICE ENGINEER

Manufacturer of refinery processing materials has an opening for a Petroleum Chemist or Engineer for technical service to the petroleum industry.

The position will entail considerable travelling, primarily in the Gulf Coast area, doing field work with local representatives assisting them with their sales and product application in oil refineries.

Applicants must be 30 to 40 years of of age, know chemical and mechanical processes and equipment and have experience in operating or refinery engineering.

Reply giving full details of education, experience and personal status to F. B. Johnston, Box No. 3 P. E., 117 Liberty Street, New York 6, N. Y.

Information Service Booklet Available

Basic information sources of the oil industry have been compiled by the Business Information Service, Department of Commerce. Copies of the booklet are available from the Department of Commerce Field Office, 1114 Commerce St., Dallas, Texas, or Department of Commerce, Washington 25, D. C. Price of the booklet is 10 cents.

Mexican Oil Prospects Good

President Miguel Aleman of Mexico told his people that the position of the government-backed Mexican oil industry is promising and the stabilization of the peso "is giving the good results we expected." In his annual report to the nation Aleman stated that prospects for the country's oil industry, financed by Mexico's own money, are promising. Of 137 new wells drilled last year, 85 are producing oil. Aleman didn't mention the proposed Mexican oil loan asked from the United States.

On the same day of Aleman's speech in Mexico City, Truman predicted in Washington that eventually the United States and Mexico will reach a satisfactory agreement on an oil loan for Mexico. He said negotiations on the project will continue.

Corporations Merge

The merger of Pan-American Petroleum Corporation and Root Petroleum Company into Pan-Am Southern Corporation was announced.

Bruce K. Brown, president of Pan-Am and Dwight F. Benton, president of Root, said headquarters of the new corporation, a subsidiary of Standard Oil Company (Indiana) will be in New Orleans, Louisiana.

CORROSION MEN

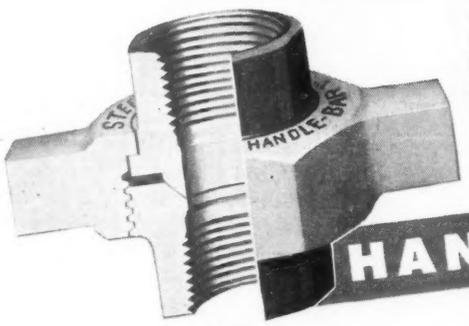
Must have broad thorough technical education, not less than five years of successful experience in application of cathodic protection to underground metallic structures, also broad knowledge of application of insulating coatings used to protect against electrolytic and anaerobic corrosion. Box 106, c/o The Petroleum Engineer, P. O. Box 1589, Dallas, Texas.

ENGINEER

Thorough university background followed by five or more years of outstanding achievement a definite requirement. Must have creative ability, a precision-technical mind. Men of less ability should not make inquiry. Salary commensurate with rigid requirements. A Missouri corporation. Correspondence confidential. Box 107, c/o The Petroleum Engineer, P. O. Box 1589, Dallas, Texas.

FIRST CHOICE IN FORGED STEEL UNIONS

For over 35 years these Unions have given consistent and dependable service in the Oil and Gas industries. Universal acceptance and present demand, which is now greater than ever, make them the number one Unions.



HANDLE-BAR

Sizes 3/8" to 4"

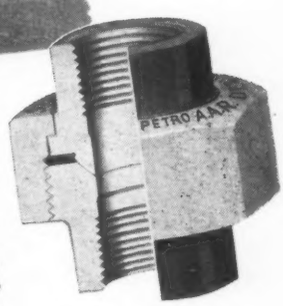
These easy to handle Hi-Speed Handle-Bar Unions have integral steel to steel seats, or completely fused bronze to bronze seats. The nut threads are modified Acme to facilitate easy and speedy assembly and disassembly. The seat design is a 45 degree cone, machined and cold rolled, to a ball seat on the male end. Furnished in black hub ends with Udylited nut, or all rustproof with Udylited hub ends and Parkerized nut.

4000 Test Unions sizes 3/8" to 4" inclusive are furnished with Briggs Standard steam threads in pipe ends.

6000 Test Unions sizes 2" to 4" inclusive have long pipe ends with A.P.I. line pipe threads.

HANDLE-BAR Unions are recommended for all services. Use a hammer instead of a wrench to tighten or loosen the nut.

PETRO



This Union has features that make it the most universally used Union. It is made to A.A.R. standards with integral steel to steel seats. The seat design is a 45 degree cone, machined and cold rolled, to a ball seat on the male end. The ends and nut are extra heavy and the nut threads are permanently lubricated and rustproofed with Udylite Cadmium.

A partial list of PETRO'S proven services include pressures from a vacuum to 3000 lbs.; Temperatures from 100° below zero, F., to 1000° above zero F.; on Steam, Gas, Air, Oil, Gasoline, Ammonia, Chemicals, and all other services in which Steel or Wrought Iron Pipe is used.

Sizes 1/8" to 3"

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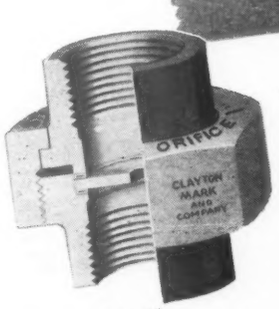

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"ORIFICE" Unions, screwed, or socket weld are widely used for flow control of Steam, Oil, Ammonia, Chemicals, Water, Gas and Air. Also for metering and measuring. The ORIFICE is recommended for working pressures of 600 lbs. at 900° F., or 2000 lbs. at 150° F. Furnished with 18-8 stainless steel orifice plate and steel jacketed asbestos filled gaskets. These are set in a groove of solid steel to facilitate ease of tightening and to safeguard against possible blowing of the gaskets and resultant trouble.

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PERSONALS

H. S. M. Burns was elected a director and president of the Shell Oil Company and Alexander Fraser, former president, was elected chairman of the executive committee. Shell Oil Company is the new name of Shell Union Oil Corporation. **George Legh-Jones** will continue in his present capacity as chairman of the Board of Directors. All vice presidents of the subsidiary company were elected to similar positions in the consolidated company. **P. E. Lakin,** vice president, was also elected a director and will continue as the company's senior representative on the Pacific Coast.

George S. Smith has been made plant engineer at the Stanolind operated Elk Basin plant in Park County, Wyoming. Smith joined Stanolind March 8, 1945, and has been at Elk Basin since February of this year.

The Elk Basin plant was built primarily as a conservation project for pressure maintenance in the Elk Basin Field. It is a three-way operation: Natural gasoline, sulphur production, and inert gas generation.

W. C. MacMillan was elected executive vice president of Continental Oil Company, effective immediately, it was announced by L. F. McCollum, president.

At the same time he announced the election of **Serge B. Jurenev,** secretary of the company, as vice president in charge of coordinating and planning, and the election of **Rawleigh Warner, Jr.,** to succeed Jurenev as secretary.

MacMillan, formerly vice president and administrative assistant to the president, has been with Continental Oil Company for more than 20 years. He attended Brown University and joined Continental in the geological department.

Jurenev, following his graduation from Dartmouth College in 1925, was associated with J. P. Morgan and Company, Inc., for 16 years. He joined Continental Oil Company in 1942.

Warner, formerly assistant to the treasurer of Continental Oil Company is a graduate of Princeton University. He joined Continental in 1948.

Several employees of Stanolind Oil and Gas Company's research laboratory in Tulsa, Oklahoma, have received promotions. **George Roberts, Jr.,** manager of the research department, announced that **Charles E. Buffum, Ralph E. Hartline** and **Harold M. Lang** have been advanced to new positions.

Buffum, who joined the company in 1934, was formerly construction and technical service section supervisor before being named to the post of research group supervisor.

Hartline was a senior research engineer before being advanced to research group supervisor. He has been employed by Stanolind since 1943.

Lang, who was instrument shop supervisor at the laboratory, has been named senior research engineer. He has been with Stanolind since 1935.

Harold L. Kennedy, former Washington attorney for the Mid-Continent Oil and Gas Association, has joined the legal staff of The Ohio Oil Company. He will be associated with the Ohio's legal department in its Houston, Texas, division. In addition to his general legal duties he will be in charge of the Washington, D. C. office of the company.

Kennedy was graduated from the University of Texas Law School and admitted to the Texas Bar in 1938. He became the Washington attorney for the Mid-Continent Oil and Gas Association in 1946.

Bentley G. McCloud, president and director of the First National Bank of Chicago, Illinois, was recently elected a director of Standard Oil Company (Indiana).

McCloud fills the vacancy on the Standard Board caused by the recent resignation of Bruce K. Brown, vice president and a director. Brown has become president of Pan-Am Southern Corporation, a Standard Oil (Indiana) subsidiary with headquarters at New Orleans, Louisiana.

Aubrey W. Schofield, former assistant managing director of Kuwait Oil Company, Ltd., has been placed in charge of Eastern Hemisphere operations under the supervision of C. W. Hamilton, Gulf Oil Corporation. Hamilton is vice president in charge of foreign operations, in New York. J. M. Cooper, formerly with Gulf production organization in Houston, succeeded Schofield with the Kuwait company.

E. S. Bleeker, former Gulf chief geologist in the foreign production division office in New York, has been placed in charge of Western Hemisphere operations.

Erbert R. Lewis, Chicago, Illinois, has been named president of the newly formed Richland Oil Development Company, which was organized through merger of Richfield Oil Company, Helena, Montana, and Northwest Development Company, Cheyenne, Wyoming. **E. J. Preston,** Salt Lake City, Utah, is executive vice president of the company. **Dean Hole,** Chicago, is secretary-treasurer.

J. J. Arps

C. D. Miller, executive vice president of the British - American Oil Producing Company announces the appointment of **J. J. Arps,** formerly chief engineer and assistant general superintendent, to the newly created position of manager of production research and economics.

Arps is a graduate of the technical University of Delft, Holland, and obtained his Masters Degree in mining engineering and Geology. He was first employed by the Shell Oil Company in various parts of the world as petroleum engineer and joined British-American in 1940 as district engineer and later as district superintendent for the Gulf Coast area.

W. A. Bruce and **E. M. McNatt** have been made assistant chiefs of research of The Carter Oil Company. **M. W. Kriegel,** a Carter scientist since 1940, was named head of exploitation research replacing Bruce and and **R. R. Thompson,** New York, senior geophysicist with the Standard Oil Development Company, has been appointed head of geophysical research, at Tulsa, replacing McNatt.

Bruce has been with Carter since 1938, and McNatt joined Carter in 1939 and is vice-president of the Geophysical Society of Tulsa. Dr. Kriegel has been on the Carter laboratory staff since 1940.

Thompson has been on the production research staff of The Standard Oil Development Company the past three years. He was graduated from the University of Texas in 1928.

P. A. Dickey continues as head of geological research and **F. G. Boucher** as head of development engineering.

William D. Mason, Sun Oil Company director in charge of industrial relations, has been appointed, to the executive committee of the Chester and Delaware County (Pennsylvania) Chamber of Commerce. He also serves as chairman of the airports and aeronautics committee.

OIL and GAS TRADE NEWS

Graver Expands Department

E. N. Gosselin, president of Graver Tank and Manufacturing Company, Inc., has announced the establishment of the Graver Water Conditioning Company as a division of the company to extend the operations which have been conducted by the Graver water conditioning and process equipment department.

Graver has been actively engaged in the water conditioning field for 40 years, and the expansion of the staff and facilities that accompanies this development enables the company to provide individualized and complete technical, chemical, engineering, manufacturing, and erection services for all water treatment.

Distributors Named

The recent appointment of Lucey Export (Canada) Ltd. as distributors for Bucyrus-Erie oil well spudders is announced by Bucyrus-Erie Company, South Milwaukee, Wisconsin. They will sell and service these oil-field machines throughout the Provinces of Alberta and Saskatchewan and in that portion of the Northwest Territory immediately north of Alberta.

Lucey Export recently took over the operation of Drilling Supplies Ltd., Lucey Equipment (Canada) Ltd., and Mineral Sales Ltd. The company will handle the four models of Bucyrus-Erie spudders—24-L, 28-L, 36-L and 48-L.

Officers at the Calgary office are E. M. Wilkinson, managing director; J. J. Saucier, K. C., director; and H. W. Miles, sales manager.

Form Canadian Corporation

Hughes Tool Company has formed a Canadian Corporation, Hughes Tool Service Limited, with headquarters in Calgary, Canada. The company is constructing its own main warehouse in Edmonton and will lease rock bits through its authorized distributors patterned after its United States operations, with stocks maintained at strategic points.

H. E. Snelson, a Canadian, formerly Rocky Mountain division engineer, has been made Canadian district manager. R. T. Helmer continues his duties as Canadian district sales representative.

Officers of the Hughes Tool Service Limited are: M. E. Montrose, president, Houston Texas; W. L. Hunter, vice president, Oklahoma City, Oklahoma; F. E. Jacobs, treasurer, Houston; and R. T. Helmer, secretary, Calgary.

Get New Warehouse

Harnischfeger Corporation, manufacturer of materials handling machinery marketed under the P & H trademark, recently opened its new Southwest district office and service warehouse building at 1225 North Industrial Boulevard in the Trinity Industrial District, Dallas, Texas.

Formerly at 2223 Commerce Street, the Dallas branch is now housed in a one-story structure fronting 125 ft on North Industrial Blvd., and contains more than 10,000 sq ft of warehouse space, providing overall space of 22,500 sq ft.

All operations at the new district office and warehouse are under the direction of James H. "Jim" Enochs, district manager, who has been with P&H for more than 27 years. For 21 years he has been in charge of the Dallas branch, covering Texas, Oklahoma, New Mexico, and part of Louisiana.

Open New York Office

The Big Four Machine and Supply Company, manufacturers of oil field equipment, Clay City, Illinois, has recently opened an office in New York City, according to John R. Riley, president of the company.

Jack Askins will be the Big Four representative at the office, located in suite 1684 of the Woolworth Building.

J. H. Enochs

New Harnischfeger district office.

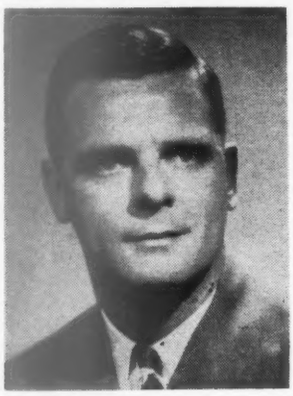
Photographed with the Hughes Tool plane in Canada are, left to right: M. E. Montrose, vice president, sales, Houston, Texas; W. L. Hunter, northern region manager, Oklahoma City; S. J. Lintzenich, Rocky Mountain division manager, Casper; H. E. Snelson, Canadian district manager, Calgary; R. T. Helmer, Canadian sales representative, Calgary; E. R. Woodmansee, manager tool joint sales, Houston.

Opens New Office

A new branch office with a warehouse stock of orifice fittings, check valves, orifice flanges and plates has just been opened in Odessa, Texas, by the Daniel Orifice Fitting Company. This new branch is headed by Walter Beal. All of Western Texas and the Permian Basin area will be served from this new location.

Sales Office Opened

Bethlehem Supply Company, of Tulsa, Oklahoma, announced the opening of a sales office at San Antonio,



Guy Brown, Jr.

Texas, 404 Milam Building, with Guy Brown, Jr., as engineering representative.

Brown graduated from the Missouri School of Mines in 1940, with the degree of Bachelor of Science in metallurgical engineering. After joining the Bethlehem Steel Company, he spent one year at Bethlehem, Pennsylvania, and was then transferred to Tulsa.

W. J. Brady, manager of the Southwest Texas district at Corpus Christi, has supervision over the San Antonio branch.

Plant Nears Completion

An unusual manufacturing layout is nearing completion at the Chicago Pneumatic Tool Company's new plant in Utica, New York. The main building alone is over 1/5th of a mile long and nearly half as wide.

CP engineers laid out two six-acre sections; the west section to manufacture tools having a rotary action; the east section tools with a reciprocal action. A horseshoe production line was then laid out for each operation, and the plant was actually built around the whole.

Separated from the main structure are buildings for the forge shop, plating shop, power plant, and foundry. Designed by the National Engineering Company, the sand handling equipment and core oven installations are almost entirely mechanized. Each division has its own air conditioned sound proofed physical, chemical, and metallurgical laboratories.

W. H. Connor

E. C. McCann

Ray O'Rear

Howard Reid

Representative in Casper

W. H. Connor, of W. H. Connor, Inc., Casper, Wyoming has been appointed representative in the Rocky Mountain area for the Maloney-Crawford Tank and Manufacturing Company of Tulsa, Oklahoma, according to S. P. Wallace, Maloney-Crawford president. Connor has been associated in the steel tank and separator business for many years.

New Edward Laboratories

New metallurgical, physical, and chemical laboratories have been recently completed for Edward Valves, Inc., East Chicago, Indiana, and are now in operation. Manned by skilled laboratory engineers, these new laboratories will be used for extensive research and development work on Edward and Nordstrom steel valves.

These Edward labortories are devoted exclusively to steel valve research and the problems related to the manufacture of steel valves. Equipment has been acquired from Great Britain, Switzerland, Sweden, the Netherlands, France, Germany, Austria, and other countries as well as the United States.

Technical Oil Tool Changes

Eugene (Gene) C. McCann has recently been named field engineer for Technical Oil Tool Corporation, Ltd., in Lafayette, Louisiana, replacing John L. Brown. With several years of oil field experience, McCann has for some time resided in Lafayette.

Ray O'Rear has been promoted to Gulf Coast division manager for Technical Oil Tool. He has worked with the company in West Texas, Louisiana, and in Houston.

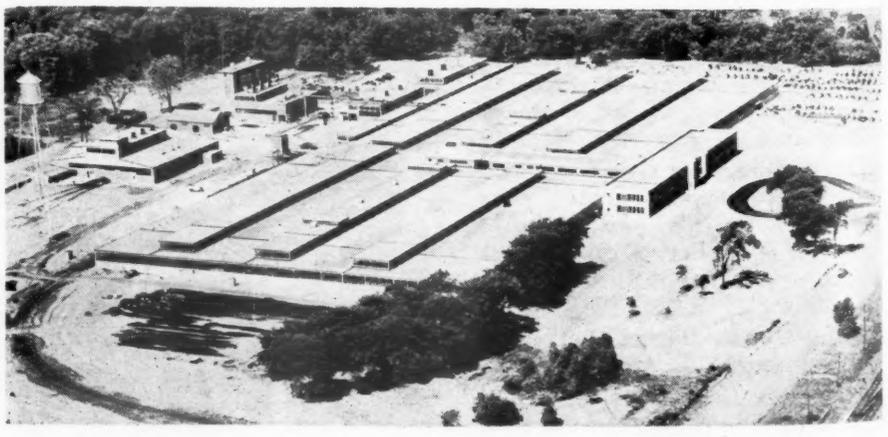
Howard Reid, with many years' oil field experience in Louisiana and Mississippi, has been appointed to work in the Houston area.

Begins Canadian Operation

Announcement has been made by The Continental Supply Company, Dallas, Texas, relative to the inauguration of a Canadian operation.

Headquarters for this latest expansion in Continental service are at Calgary, Alberta, Canada, with J. H. Berry as managing director. Stores are maintained at Edmonton, with V. H. Von der Lin as manager and at Lloydminster, Saskatchewan, E. F. Fitzsimonds, manager.

Site of Chicago Pneumatic Tool Company's new plant in Utica, New York. The main building alone is over 1/5th of a mile long and nearly half as wide.



Open Tulsa Office

Protective coatings division of Pittsburgh Coke and Chemical Company announces the opening of a new office

F. E. McNulty

B. H. Means

at 711 Thompson Building, Tulsa, Oklahoma, to serve the Central Midwest. Frank E. McNulty, former manager of the Koppers Company's Tulsa office, has joined the protective coatings staff as manager of the new office.

Appointment of Benjamin H. Means as service manager of protective coatings for the entire United States has also been announced.

Nooter Company Changes Name

The John Nooter Boiler Works Company, St. Louis, Missouri, became known as the Nooter Corporation effective October 1, 1949.

Nooter's services have increased and their scope of service grown to such a point that Nooter is no longer just a "boiler works" as the former name implied. That's why the John Nooter Boiler Works Company name has been changed to Nooter Corporation.

Appoint Representatives

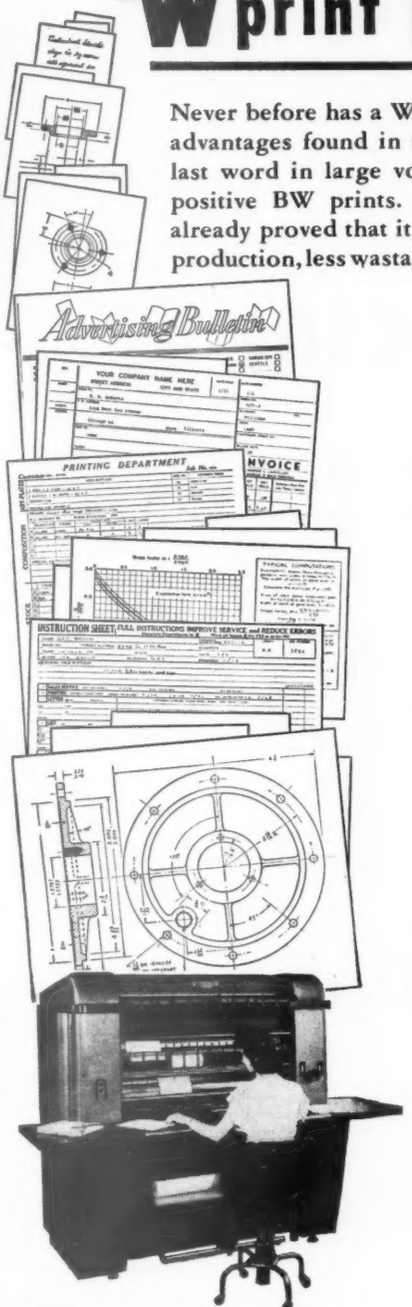
Appointment of the S. D. Day Company, Houston, Texas, as Southwest representative for Pittsburgh Protective Coatings has been announced by Robert H. Moore, sales manager of Pittsburgh Coke and Chemical Company.

S. D. Day, head of the sales firm, has been active in the N.A.C.E. and a practical student of pipe line corrosion for over 20 years.

Acquires Electrimatic

Jas. P. Marsh Corporation of Skokie, Illinois, has announced the purchase of Electrimatic Valve Division of Simoniz Company of Chicago, Illinois. All Electrimatic valves will now be manufactured and distributed by the Marsh Corporation. The Electrimatic includes pressure actuated condensing water regulators for control of cooling water through condensers, solenoid stop valves for larger cooling systems, suction throttling valves, and back pressure regulators.

large volume BW print production



Never before has a Whiteprinter been able to offer you all the advantages found in this new Volumatic Model 93. It is the last word in large volume production of high quality direct positive BW prints. Advance models of this machine have already proved that it reduces reproduction costs . . . by faster production, less wastage, lower maintenance, simpler operation.

It has countless uses. The Volumatic, like other Bruning Whiteprinters, produces sharp, highly legible copies of engineering drawings and documents . . . anything that is printed, drawn, written or typed on a translucent medium. Its uses increase daily as more and more business and industries turn to the BW Process to eliminate the costly practice of transcribing documents, forms and records of all kinds.

It is extremely versatile. The Volumatic Model 93 produces sharp BW prints from post card size up to 42-inches wide and unlimited length. You can have light, medium or card weight prints . . . prints on tinted stocks . . . prints on film or cloth . . . prints with colored lines.

Anyone can operate it. The operation of the BW Model 93 has been simplified to the point where a girl can learn to operate it in less than an hour.

Faster operation. The new Volumatic produces BW Prints at speeds up to 105 square feet a minute. The prints are delivered dry and ready for instant use.

Completely odorless. The BW Process is completely odorless. BW machines do not require outside ventilation or exhaust ducts. They can be installed *anywhere* without offense.

It is mobile. There are no pipe or plumbing connections to tie this machine to one spot. It can be moved to convenient locations.

Uniform quality control. BW Model 93 automatically and instantaneously coordinates developing and printing speeds. Changes in printing speed never result in over or under developed prints. A further safeguard to quality is Bruning's built-in constant wattage transformer which assures uniform operation of the machine although line voltages may vary from 190 to 250 volts AC.

BRUNING BW WHITEPRINTER
VOLUMATIC MODEL 93

Send today **for full information.** Let us send you a complete file of literature describing the new BW Model 93 and the BW mediums you can use with it. See for yourself the extreme versatility, economy and speed of this machine. There is no obligation.

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Other Bruning products you should know about — Drafting Machines Sensitized Papers & Cloth · Tracing Papers · Erasing Machines · Drafting Room Furniture · Slide Rules · Surveying Instruments · and many other products.

ANNOUNCING

THE TEXAS SPECIAL TO CHICAGO FOR THE API AMERICAN PETROLEUM INSTITUTE CONVENTION

NOV. 7-10 1949

Katy Texas Special will leave Dallas at 6:50 p.m. Saturday, November 5, 1949. Special sleeping cars with room and open section accommodations are now being arranged from South Texas points as well as from Dallas. Make your reservations early.

For further information, contact
MAX P. CURTIS, D. P. A.
1303 Commerce St., Dallas, Texas
or your local
KATY REPRESENTATIVE

M-K-T KATY RAILROAD MISSOURI-KANSAS-TEXAS

574

MISSOURI-KANSAS-TEXAS RAILROAD SYSTEM

Named To Export Division

Harry E. Lewis has been assigned to the foreign and export department, Worthington Pump and Machinery Corporation, Harrison, New Jersey. George Bourque has been appointed works comptroller at Holyoke, Massachusetts, to succeed Lewis.

W. S. Blakeslee Promoted

W. S. Blakeslee, Jr., Gar Wood Industries, Inc., has been named assistant general sales manager for the corporation.

Prior to his appointment Blakeslee was sales manager of the Wayne division, in Wayne, Michigan. He has been with Gar Wood since 1935, with the exception of service in the Army during the war. R. J. Nymberg will succeed Blakeslee as sales manager of the Wayne division.

Made Vice President

Charles A. Butcher has been elected a vice president of Elliott Company. Butcher will continue to function as general manager of the Crocker-Wheeler Electric Manufacturing Company, Ampere, New Jersey, a recently acquired division of Elliott Company.

Makes Personnel Changes

W. L. Coleman, Bethlehem Supply Company, has been transferred to Ardmore, Oklahoma, and will operate as a field salesman in that area. A. M. Taylor has been transferred to Seminole, Oklahoma, and promoted to the position of field representative to replace Coleman.

C. W. Young, a special representative, has been transferred to Garden City, Kansas. F. M. Matzke has recently joined the Bethlehem Supply Company as field representative and will work out of the Casper, Wyoming, store.

To Build Houston Plant

The A. O. Smith Corporation of Milwaukee, Wisconsin, has announced the formation of a company, "A. O. Smith Corporation of Texas," which will build and operate a plant in Houston, Texas, for the manufacturing of welded steel pipe both for gas and oil transmission lines, and for oil well casing.

The line pipe will range in diameters down to 8⅝-in. and up to 30-in. and larger, if required, and will be fabricated in uniform lengths of 40 ft. The plant wil have a capacity of from 30,000 to 35,000 tons of pipe per month and will be the second largest mill in the country for the production of welded pipe.

Telecomputing Service Announced

An engineering computing service has been developed by a group of prominent research engineers active for the past decade in the developments of aeronautics. Known as the Telecomputing Corporation, Burbank, California, the organization combines engineering research with special automatic electronic calculating machines to compute numerical values and problems essential to converting theory and design into production.

Opens Oxygen Plant

Magnolia-Airco Gas Products has opened a new oxygen plant in Hobbs, New Mexico, according to J. F. Pryor, president. The announcement disclosed that the new plant will also serve as an acetylene warehouse point. The plant superintendent is William Bowhay.

Moves To New York

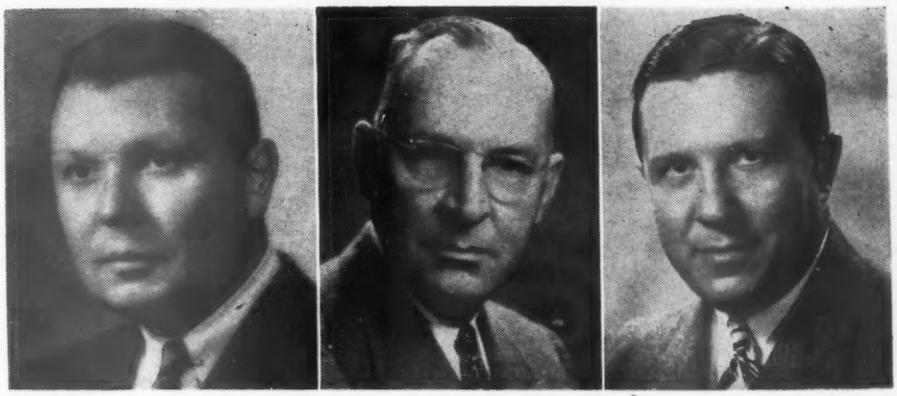
Graver Water Conditioning Company announces the removal of its general offices to larger quarters at 216 West 14th Street, New York 11, New York. The company is a division of Graver Tank and Manufacturing Company, Inc., which has manufactured and erected equipment for all water treatment and liquid conditioning processes for 40 years.

Combine Departments

T. M. Evans, president of H. K. Porter Company, Inc., has announced the movement of the manufacturing departments of the Brake Equipment and Supply Company, and Jarecki Manufacturing Company, to the Hinderliter plant in Tulsa, Oklahoma. Manufacturing facilities will be combined, but will retain their individualities and trade names.

The valve and fitting manufacturing plant of the Jarecki Company is being moved from Erie, Pennsylvania. Howard Pape, Jarecki vice president and director, will continue in the Jarecki sales headquarters at Houston, Texas.

C. J. Smith, now manager of the Brake Equipment Company in Chicago, will move to Tulsa. R. A. Campbell is general manager and vice president of Hinderliter.



T. M. Evans | Howard Pape | R. A. Campbell

Obtain Controlling Interest

Sale of the controlling interest in Texsteam Corporation of Houston, Texas, to Vapor Heating Corporation of Chicago is announced by J. M. Sheesley and Otto Schoenfeldt, former Texsteam officials.

Purpose of the sale is to provide ample facilities for the manufacture of a 500 hp 500-lb working pressure, automatic oil field boiler that has been under development and test for several years. Manufactured under Vapor-Clarkson patents, the boiler will be produced for Bettis Corporation of Houston and will be distributed under the trade name "Bettis Boiler." A. J. Loose will be in charge.

Hold Formal Opening

The formal opening of Mid-Continent Supply Company's newest field store, in the Scurry County area at Snyder, Texas, was celebrated August 26 with an open house and barbecue. Ken W. Davis, president and general manager, estimated that around 1800 guests attended.

Insulate Steam-Line At Gulf Refinery

An example of the insulation of a type of pipe line to which standard sectional pipe covering is not well adapted is provided by an application of Fiberglas Aerocor insulation to a 6-in. pipe line traced with a ½-in. steam line at the Gulf Refining Company's Toledo refinery.

The Fiberglas Aerocor used for the Toledo job is a blanket type, flexible material, with a density of 1½ lb per cubic foot, composed of extremely fine glass fibers bonded with a thermo-setting resin, and comes in compressed roll packages ½ in. by 36 in. by 100 ft.

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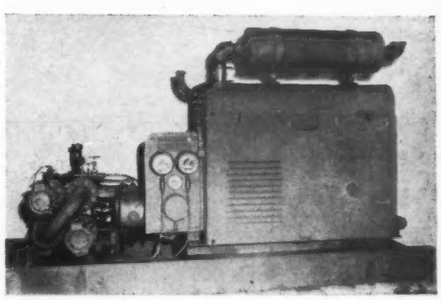
GET PHOENIX
They're drop forged of mild steel, easily machined or welded. Meet ASA requirements and ASME and ASTM specifications. The Phoenix line is complete . . . that means dependable flanges for every job. Write for the Phoenix catalog today!

Flange & Hook Division
PHOENIX MANUFACTURING COMPANY
Catasauqua, Pa. Joliet, Illinois

BYRON-JACKSON "P.U.P." TWO STAGE PUMPING UNITS
FOR GASOLINE—CRUDE—WATER
SURPLUS — NEW

New, Crated for Export with Parts and Tools

Attractively Priced



This unit consists of one 3-inch, 2-stage Byron-Jackson "PUP" Pickup Centrifugal Pump—3-inch Suction and Discharge, 4-inch Adapters for couplings, 200 BPH at 680-feet head or in parallel 400 BPH at 340 feet head, direct connected to Chrysler Model C-36 (Ind. 9) — Industrial 8-cylinder Engine, Skid Mounted. Wt. 4060 lbs. Skid length 9 feet 6 inches, Height 62 inches, Width 29 inches.

MAXIMUM PUMP EFFICIENCY-FLUID WATER

	RPM	PSI	GPM
Parallel Hook-Up	1800	105	480
	2200	155	590
	2400	185	650
Series Hook-Up	1800	210	240
	2200	305	295
	2400	360	325

Complete with Electric Starter, Generator, Battery, Etc.—Ideal for Salt Water Disposal Wells—Excellent Fire Pumps

HALLORAN Equipment Co.
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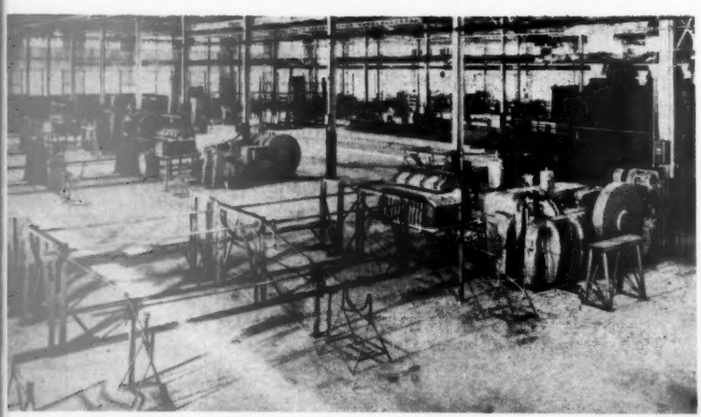
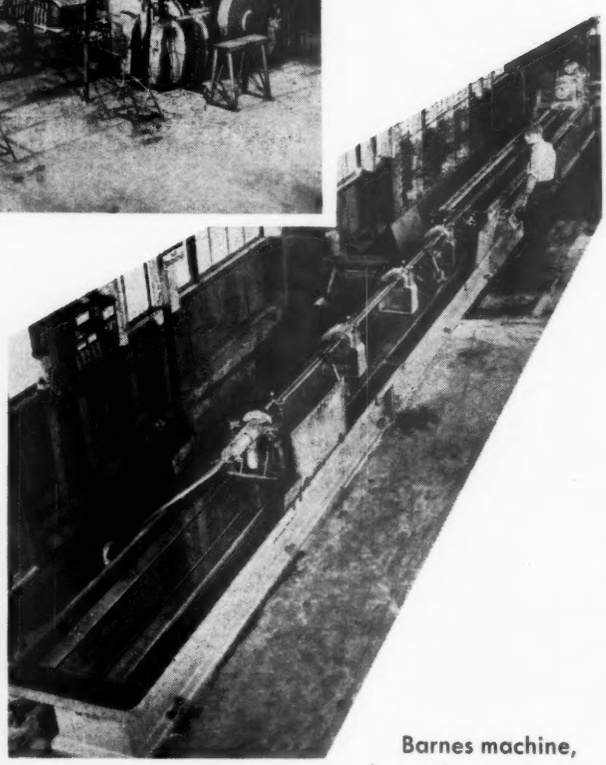
Emsco Opens New

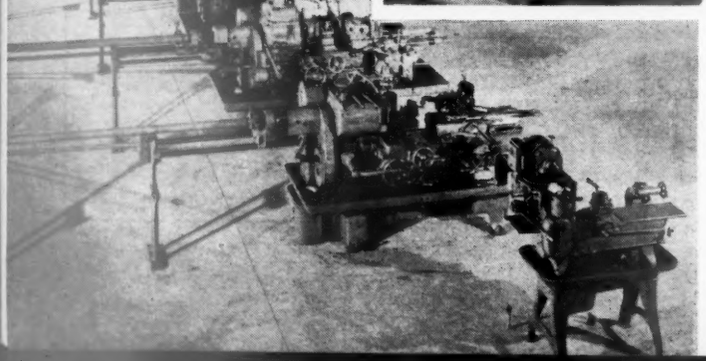
Aerial view of new ultramodern D+B plant at Garland, Texas. Garland is a growing, friendly industrial community 15 miles northeast of Dallas.

General overall view of sucker rod section of main shop building with forging furnace in foreground.





Battery of turret lathes used for the precision machining of D + B deep well plunger pumps and allied accessories.



Barnes machine, above, for precision honing of pump tubes and working barrels.

OVER four and one-half decades of specialized experience in the manufacture of sub-surface pumping equipment are climaxed by the opening of the new ultra-modern D + B plant in Garland, Texas. This new plant, operated by Emsco Derrick and Equipment Company is now in full production of a complete line of D + B oil well plunger pumps, sucker rods, couplings, and miscellaneous production accessories for the oil fields.

D + B's new Mid-Continent plant covers nearly 15 acres and features the latest and most modern machinery for the manufacture of sub-surface pumping equipment. The entire plant was designed, built, and tooled solely for the production of sucker rods, sucker rod couplings, and deep well plunger pumps and accessories. Many pieces of machinery in the new D + B plant are the only ones of their kind in the world, having been specially designed for installation in the new D + B Garland plant. Typical of these new modern custom-built machines are the full length normalizing and drawing furnace for the precise heat covers nearly 15 acres and features treatment of sucker rods, the special continuous type rod cleaning machine for blast cleaning and/or shot peening of sucker rods, and the automatic machine for painting and drying of D + B rods.

The main office building embraces a total of approximately 5400 sq ft, completely air-conditioned, and is equipped with the latest, most modern office facilities. The shop building is of steel frame construction, composed of five 50 ft bays, each 360 ft long. Each bay is serviced by a 5-ton monorail-type bridge crane. Craneways are provided with cross transfer tracks permitting movement of cranes into other bays of building. A spur of the M-K-T railroad runs inside the main shop building in the warehouse area. Five railroad cars can be spotted within the building, permitting protected loading and unloading in all kinds of weather. The reinforced concrete shop floor is elevated, thus allowing railroad cars to be unloaded at car

New D+B Plant

floor level. Illumination is provided by a combination of incandescent and mercury vapor lighting. All water piping and electrical conduit is set beneath floor. A central heating plant circulates hot air to the various parts of the plant. This is supplemented by hot air ducts running from the cooling bed of the full length normalizing and drawing furnace.

Three separate buildings make up the new D + B plant. These are: The office building facing Belt Line Road; the combination guard house, change room and clock house building at the plant entrance; and the main shop building.

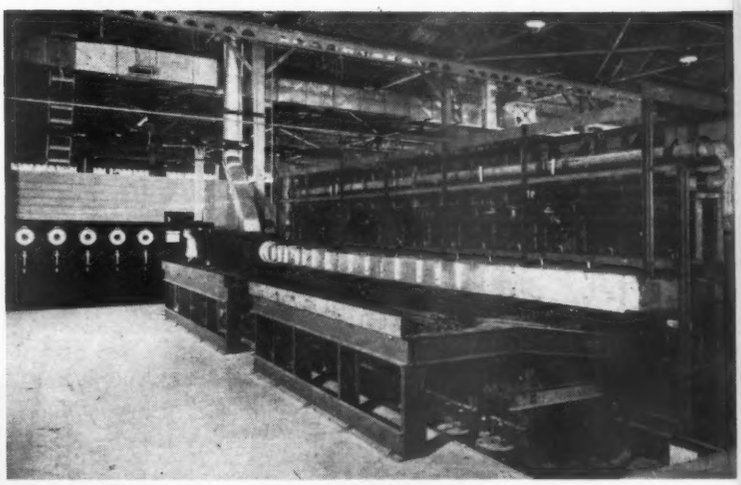
D + B has had a long and varied history. It was originally founded in 1905 by Daniel Daniels, and the first shop building was constructed in Los Angeles in March of that year. Oil well plunger pumps at that time consisted of cast iron working barrels, made from cylindrical castings bored out and reamed smooth, equipped with steel plungers and rough cast iron collars on each end. Daniels developed and perfected the first sectional liner pump, now the accepted standard of the industry for efficient service under severe pumping conditions. In May 1908, Lysle P. Burgess joined Daniels to build the revolutionary sectional liner pump, and in 1909 the young company was incorporated as the D + B Pump and Supply Company. From this modest beginning, D + B has continued to grow and expand. In the fall of 1927, Emsco Derrick & Equipment Company purchased the two manufacturing plants of D + B Pump and Supply Company.

All D + B sub-surface pumping equipment is distributed by The Continental Supply Company in all areas of the United States with the exception of California, where D + B has its own field stores. The Continental Supply Company has more than 70 field stores and offices in all major domestic oil-producing areas. In addition, representatives are in Canada, Argentina, Bolivia, Brazil, Chile, China, Colombia, England, Ecuador, Peru, Trinidad, Uruguay, and Venezuela.

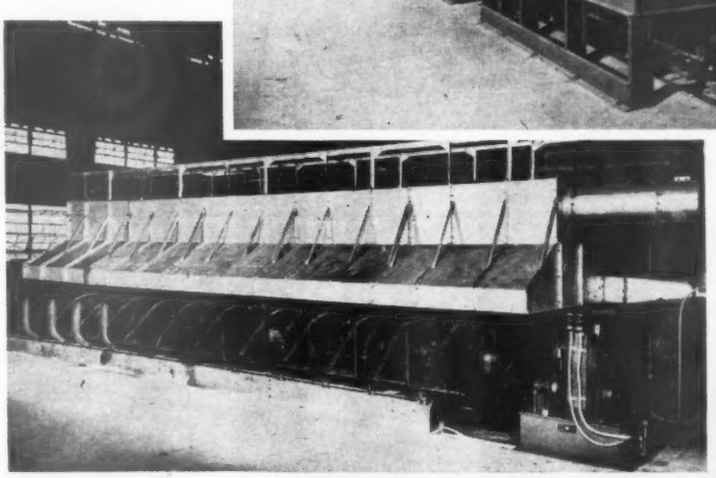
* * *

Main entrance to office building. The office building embraces a total of 5400 sq ft and is completely air-conditioned.

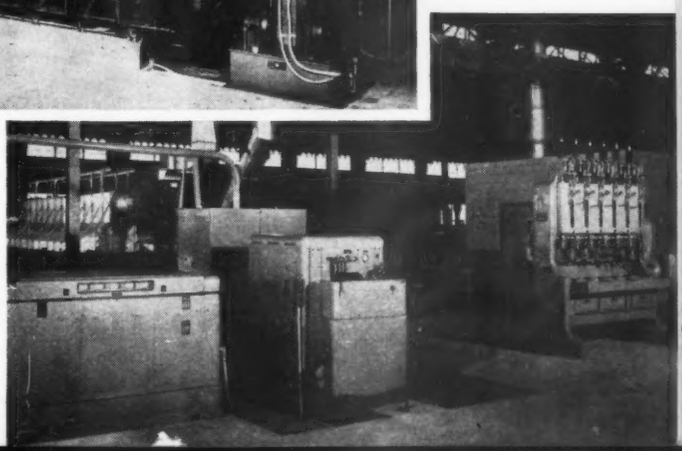
Charging end of full length normalizing and drawing furnace: Automatic recorders in background.



Discharge side of furnace that supplies precise heating for sucker rods.



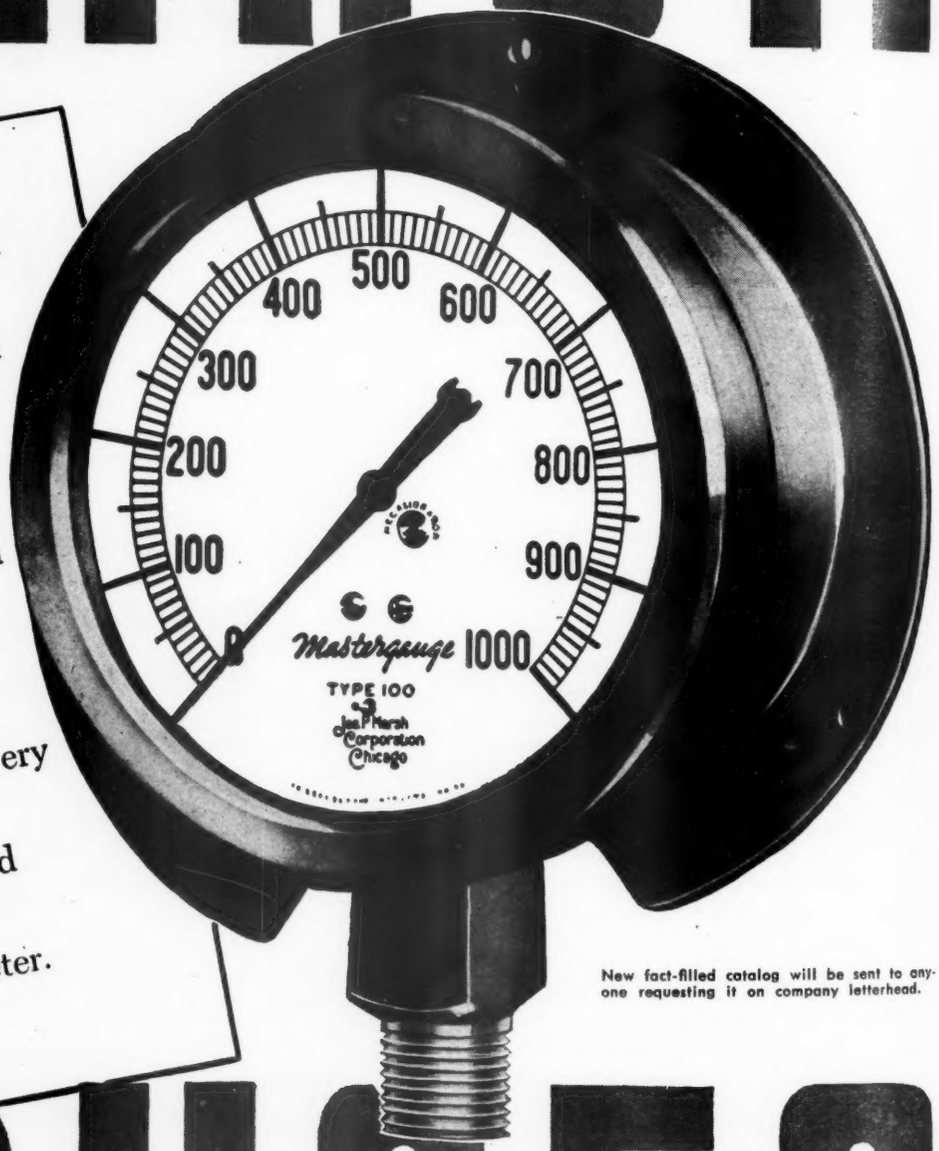
Coupling tapping machine, below, right.



High frequency induction machine, right, that case-hardens couplings.

MARSH GAUGES

All that we have learned in 80 years of precision instrument making stands before you in the design and construction of every Marsh Gauge and Dial Thermometer.



New fact-filled catalog will be sent to anyone requesting it on company letterhead.

JAS. P. MARSH CORPORATION • DEPT. M, SKOKIE, ILLINOIS

The Jas. P. Marsh line includes gauges especially designed for blenders, boilers, burners, capping, Christmas trees, columns, heaters, hydrogen units, instrument panels, pumps, Reid vapor bombs, scrubbers, separators, mud pumps, stills, towers, and other applications including oxygen and welding gauges.

TRADE PERSONALS

▸ W. H. Davison, president of Core Laboratories, Inc., Dallas, Texas, has announced the removal of West Texas

Rufe Bynum

district administrative offices from Dallas to the Wemple-Avery Building, Midland, Texas. **Rufe S. Bynum,** district engineer, will direct the international petroleum reservoir engineering firm's new quarters. Permanent laboratory facilities, also at Midland, will remain at their present site.

"ARMSTRONG BROS." Chain Tongs come in "Standard," "Reversible Jaw" and "Ideal" (V-jaw) types—in sizes for every need. Their drop-forged jaws have milled teeth, are hardened, tempered and tested for wearing qualities. They have heavy forged-in lugs that give extra bearing on the handles to which they are rigidly held by a large hardened steel bolt. The handles are forged and heat treated to the correct balance of stiffness and spring. Shackles are drop forged and chains proof-tested to ⅔ catalog strength (3,600 lbs. to 40,000 lbs.).

Stocked by Leading Tool Departments

Write for New S-48 Catalog. Just released.

ARMSTRONG BROS. TOOL CO.
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New York
San Francisco

▸ Appointment of **Raymond Sullivan** to the legal department of U. S. Steel's Oil Well Supply Company was announced in Dallas, Texas, by John C. Irwin, general attorney.

Sullivan, 27, was graduated from the Southern Methodist University School of Law in January, 1949, and is a member of the Texas Bar Association.

▸ **Lewis E. Garfield,** chief engineer of Hughes Tool Company, Houston, Texas, has been named to the newly created 15-member board of governors to direct all affairs of Rice Institute. Garfield graduated from Rice in 1926 and became associated with Hughes Tool Company in 1927.

▸ **Henry Salvatori,** president of Western Geophysical Company and Grant Oil Tool Company, has an-

Henry Salvatori

nounced that he and his associates have assumed ownership of MacClatchie Manufacturing Company, Los Angeles, effective September 1.

▸ **Hayden Jones, Jr.,** M. S. in chemical engineering from Iowa State College, **Norman Phillips,** B. S. in fuel technology from Pennsylvania State College, and **Earle Young, Jr.,** B. S. in chemical engineering from Carnegie Institute of Technology, have recently been added to the chemical laboratory staff of the research and development department of The Babcock and Wilcox Company in Alliance, Ohio.

▸ **W. M. Griffith** has been named district manager of the southern area, Pacific Coast territory, of the superior engine division of The National Supply Company. The announcement was made by Robert M. Pearson, manager of sales of the superior engine division, which manufactures diesel engines at the Springfield, Ohio, plant.

▸ After the regular monthly meeting of the Board of Directors of Seismograph Service Corporation on August 18, it was announced by G. H. Westby, chairman, that **T. A. Manhart** and **George W. Reed** had resigned as directors of the corporation.

Hugh M. Thralls, of Tulsa, was elected vice president of Seismograph. At the time of his election, Thralls was already serving as a director and as chief geophysicist of the company.

L. G. Cornish, formerly of Tulsa, and SSC employee for almost eighteen years, has recently been placed in charge of the company's Midland, Texas, office.

▸ **Harvey G. Hensel,** safety director for the western district of The Youngstown Sheet and Tube Company, has been appointed a member of the General Advisory Council to the Indiana division of labor by Governor Henry F. Schricker.

▸ Appointment of **Lloyd Wolf** as chief engineer in charge of the Twin Disc Clutch Company's engineering department at Racine, Wisconsin, has been announced by N. F. Adamson, vice president. Wolf joined Twin Disc in 1947, as chief development engineer. He is a graduate of the University of Michigan and Wayne University, Detroit.

▸ **William C. Henning,** an executive in the Wire Rope Industry for the past 47 years, died suddenly in California on September 6, after having celebrated his 80th birthday three days before. At the time of his death he was president of the A. Leschen and Sons Rope Company, St. Louis, Missouri.

Henning graduated from De Pauw

W. C. Henning

University in 1890. In 1902 he began his long career in the wire rope industry as a salesman in Kentucky and the Virginias. He joined Leschen Company in 1910 as secretary and treasurer, and became president in 1943.

▸ **B. C. Walling** has joined the Nordstrom valve division of Rockwell Manufacturing Company as a sales

B. C. Walling

engineer. He will work out of the company's Houston office, under the direction of C. K. Madison, district manager.

Walling graduated from Southern Methodist University as a mechanical engineer and also received his letter in football. For the past three years he has been employed by the Humble Oil Company as a petroleum engineer. Walling will be situated in Corpus Christi, Texas.

▸ Expansion in both heat exchanger sales and engineering and sales personnel for the Western Supply Company of Tulsa, Oklahoma, was recently made known through J. E. Hughes, manager of the heat exchanger division in the home office.

Hughes announced that Western is opening a branch office in the West Building in Houston, Texas, with Frank M. Gibbons as exchanger division representative for the Gulf Coast area. Paul R. King will continue to represent Western at Houston in the sale of pipe, valves, and fittings.

Hughes also announced the appointment of E. D. Anderson to the post of chief engineer in the exchanger division. He stated Anderson would have two new engineers working under him in the heat exchanger engineering department; Charles D. Axelrod, a graduate of the University of Oklahoma, and Edward W. Flaxbart, who received his degree in petroleum engineering from the University of Tulsa.

▸ **R. N. Crossman, Jr.** has been made oil field power sales engineer of the Houston Lighting and Power Company, Houston, Texas. He takes over the position formerly held by C. L. McNeese who has been promoted to superintendent of sales research and development of the same company.

McNeese is active in the Petroleum Electric Power Association.

▸ C. J. Tagliabue Corporation (New Jersey), wholly owned subsidiary of the Weston Electrical Instrument Corporation, has announced the appointment of the following district sales representatives:

E. A. Thornwell, Inc., Atlanta, Georgia; Ranson, Wallace and Company, Charlotte, North Carolina; Ambos-Jones Company, Cleveland, Ohio; Butler and Land, Dallas, Texas; Lynn Elliott Company, Houston, Texas; Curtis H. Stout, Little Rock, Arkansas; Geeseka and Pinkney, Minneapolis, Minnesota; Joralemon, Craig and Company, Philadelphia, Pennsylvania; J. E. Redmond Supply Company, Phoenix, Arizona; and Riddle and Hubbell, Tulsa, Oklahoma.

▸ **John Albright** has been named chief engineer of the pump division, Geo. D. Roper Corporation, manufacturers of Roper Rotary Pumps.

Albright has been employed in the

John Albright

Roper engineering department for eight years and has been responsible for much of the development and improvement in pumps and allied products. During this time, he served as consultant on special pump and hydraulic applications and will continue in that capacity in his new position.

▸ The sales and service organization of the Lufkin Foundry and Machine Company has recently been supplemented and expanded, according to L. A. Little, vice president in charge of sales.

Val Gallia has been transferred from Houston and placed in charge of a new district office in Brookhaven, Mississippi. Billy Burnett replaces Gallia in the Houston office as service engineer. Burnett goes to Houston from the main plant in Lufkin, Texas, where he has been in the shop organization for several years.

Ben Sargent has recently completed his shop trainee period and has been assigned to the Kilgore district office under supervision of Tom Crowder.

▸ **L. C. Richardson** has been appointed sales representative of The Ridge Tool Company, Elyria, Ohio's

L. C. Richardson

inter-mountain territory. States under Richardson's supervision are Missouri, Kansas, Colorado, Arkansas, and Wyoming. His headquarters are in St. Louis, Missouri.

Richardson's previous experience includes 13 years with the Stockham Pipe Fittings Company and The Grinnel Company.

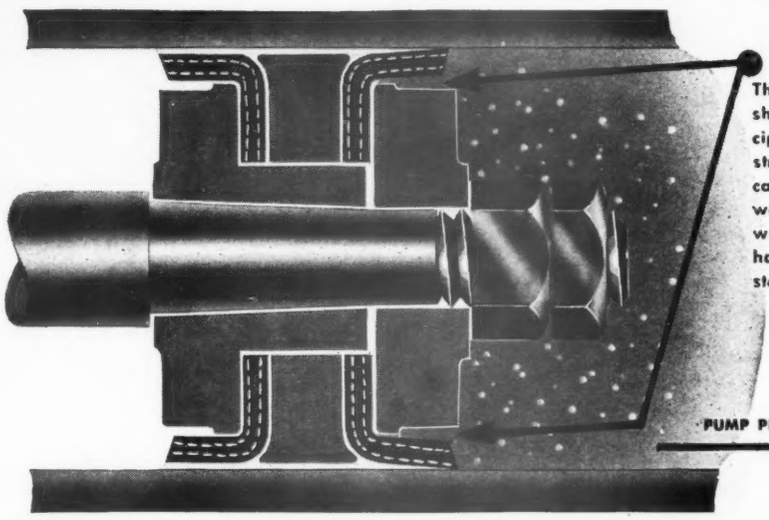
▸ **John A. Robinson** has been named regional sales manager for the Midwest, Northwest, Rocky Mountain, and Pacific Coast areas for Brown Instruments division of Minneapolis-Honeywell Regulator Company.

Robinson started with the Brown company 20 years ago at the Philadelphia, Pennsylvania, main plant. He will make his headquarters in Chicago, Illinois, where he has been branch industrial manager.

▸ **Laurence C. Johnston** was named district sales manager of the Brown Fintube Company of Elyria, Ohio,

L. C. Johnston

with headquarters in New York City. Johnston has been engaged in the heat transfer field for the past 15 years. Prior to joining Brown Fintube Company he was eastern district manager of Process Engineering, Inc. of Boston, Massachusetts, and chief engineer of the Patterson-Kelley Company, Inc.



This greatly exaggerated diagram shows the Darcova Pumcup principle. On pressure side of each piston stroke, flexible Pumcup is automatically forced against liner or cylinder wall. Firm, uniform contact all the way around eliminates slippage, holds volumetric efficiency at constant high in spite of gradual wear.

THEY NEVER RELAX
when the pressure is on!

HERE is a piston packing that actually takes *advantage* of the fluid pressure built up in reciprocating pumps and in air or hydraulic mechanisms. The illustration above shows how Darcova Pumcups utilize this pressure . . . how they hug the cylinder wall on every work-stroke of the piston, preventing needless slippage.

Then, too, friction between the Pumcup and cylinder is automatically "pressure-equalized" all the way around for a uniformity of wear otherwise impossible. And, in contrast to other types of packing, fluid slippage does not increase with wear. Peak volumetric efficiency is retained even when Pumcup wear is far advanced.

Consequently, Pumcups offer two mighty important advantages. First, downtime and material and maintenance costs are cut to a fraction because Pumcups outlast other types of packing many times over. Secondly, volumetric efficiency is held constant.

Everything considered, it is easy to see how thousands of Darcova Pumcup users are saving up to $100 per pump per year. Easily installed, Pumcups replace ordinary packing in reciprocating pumps and in air or hydraulic mechanisms. They are precision built in ½ to 42 inch sizes and in many different textures for practically all fluids, pressures and temperatures.

DARCOVA®
THE ORIGINAL COMPOSITION CUP

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City_____ State_____

▸ **R. H. Hinkson** has been named sales manager of Engineering Laboratories, Inc., Tulsa, Oklahoma, formerly was sales engineer of the eastern half of the country.

Kenneth R. Kennedy was made manager of the E. L. I. plant at Garland, Texas, where E. L. I. drilling bits, and drilling equipment are manufactured. He is a member of the American Society of Tool Engineering.

B. M. Baker now engineering manager came with the company in 1941 as an engineer. He was formerly chief mechanical engineer.

R. H. Hinkson K. R. Kennedy B. M. Baker

▸ **R. D. Jablonsky** has been named district manager at the St. Charles, Missouri plant of the American Car and Foundry Company, succeeding the late W. C. Roederer.

A graduate of Washington University, where he majored in electrical engineering, Jablonsky joined ACF in 1946 as a welding engineer. A few months later his duties were broadened to cover problems involving production, scheduling, labor relations, and plant engineering, and on May 1, 1948 he was appointed general superintendent.

▸ **Dudley W. Day,** of Prospect Heights, Illinois, has been named director of marketing of the Burgess-Manning Company. Day has been affiliated with the company for 17 years.

He is president of the National Noise Abatement Council which conducts a nationwide educational campaign on the subject of excessive noise and aids in the development of local noise abatement projects by city administrations, Chambers of Commerce and other groups.

Adds New Division

A new division has been added to the sales organization of Lufkin Foundry and Machine Company, manufacturers of oil field pumping equipment and gas and diesel engines. On October 1, a northern division with headquarters in Effingham, Illinois, increased the total of Lufkin divisions to seven. This division will service the states of Illinois, Kentucky, Indiana, and Michigan. Lewis W. Breeden of Effingham has been appointed manager of the new division. His new office was opened October 1.

For the past several years, Breeden has been a consulting engineer. Prior to that he was associated with the Carter Oil Company as a mechanical engineer during which time he had considerable experience with the selection, operation, and maintenance of oil field equipment. He was graduated from Monmouth College in Illinois in 1932 with a B.S. degree in organic chemistry.

▸ Fritz W. Glitsch and Sons, Inc., announces the promotion of **Robert L. Allen** to district manager at Cleveland, Ohio. He was formerly manager of the company's Chicago, Illinois office. Allen is a trained Glitsch technician. He attended Pennsylvania State University, and is 27 years old.

Allan Persson, University of Kansas graduate, has been appointed manager of the Chicago office. Persson, who is 26 years old, was trained in the Dallas plant of Glitsch.

▸ **J. T. Calnon's** appointment as sales manager of Cummins Sales and Service, Inc., has been announced by J. E. Everroad, president and general manager. Calnon will make his headquarters at the general offices in Fort Worth.

Calnon joined Cummins Sales and Service, Inc., in 1945 after his release from the Navy. He worked as district service manager at the company's Houston and Wichita Falls service points until he was sent to Odessa as West Texas division service manager.

▸ **L. B. Richardson,** who has been with Brown Oil Tools, Inc., for the past nine years, has been appointed service manager for the company. For

L. B. Richardson

the past four years, Richardson has been manager of the company's Louisiana division with headquarters in Lake Charles. Richardson will be in charge of the company's field services, including fishing operations, pipe testing, packer setting, casing patching, and other specialized services.

▸ **Eric G. Peterson,** general manager of Peabody Engineering Corporation, New York, New York, will continue as general sales manager of all products in all divisions.

Already known as one of industry's leading designers of combustion equipment. Peterson's new duties will broaden his supervision and interest to include the activities and welfare of all the Peadbody offices and subsidiaries throughout the world.

Although the main Peabody plant is in Stamford, Connecticut, Peterson will make his headquarters in the executive offices of Peabody Engineering Corporation, New York City.

▸ **Kenneth L. Mills** has been appointed product manager of oil field sales, Columbus division, International Derrick and Equipment Company. The Columbus, Ohio, plant manufactures IDECO's pumping units and oil field structures. Mills will correlate the work of the Columbus division's engineering, production, and quality control departments and also give technical assistance to the company's oil field sales divisions.

▸ **William H. Corwin** has just been appointed Public Relations Director of Taylor Instruments Companies, according to an announcement made by Herbert J. Noble, executive vice president. Corwin joined the organization in 1942.

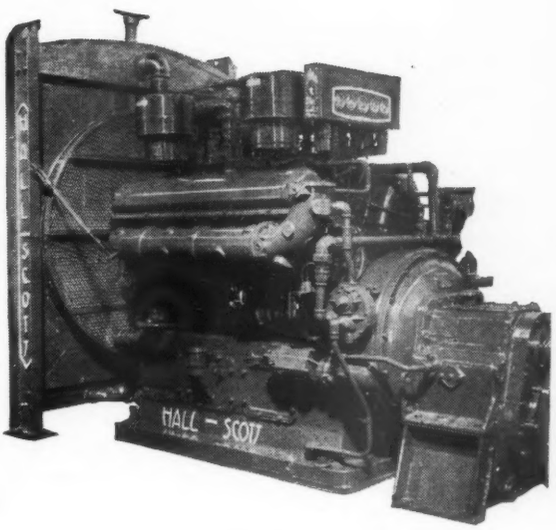
▸ **T. E. Bowers,** assistant manager of Oil Well Supply Company's West Texas district, has boen promoted to district manager.

Bowers has more than 20 years service with "Oilwell," joining the company in March, 1929. He has served in various branch sales stores in Texas, Oklahoma, and New Mexico.

Whatever the application···

count on HALL-SCOTT POWER

ROTARY DRILLING RIGS
PUMPS
GENERATORS
GATHERING SYSTEMS
INDUSTRIAL EQUIPMENT
STAND-BY SERVICE
RECYCLING PLANTS
BOOSTER EQUIPMENT



Count on Hall-Scott Engines for *dependable* power! They have been tested and proved in every type of application in pipe line, refinery, and field.

Count on Hall-Scott Engines for *economical* power! Unit construction means quicker servicing, minimum downtime. Compact design and high h.p. to weight ratio permit greater mobility and lower transportation costs.

Both the Hall-Scott V-12 and the Series 400 "sixes" are adaptable to gas, butane, or gasoline operation. Full details on request.

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MOTOR DIVISION
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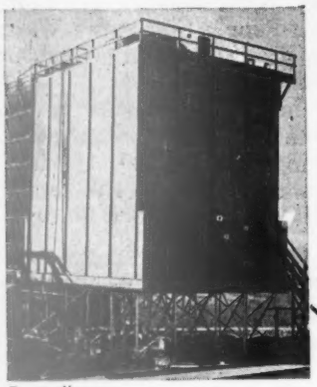
Branches: Boston • New York • Chicago • Dallas • Los Angeles • Spokane • Berkeley

"Our best ads are installed . . ."



Two cell induced draft cooling tower.

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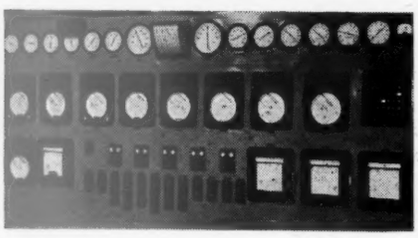

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Since 1912 we have manufactured electrical and metal products for industry
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CUBICLES
UNIT SUB-STATIONS
SWITCHGEAR
BUS DUCT
Avail Yourselves of Our Engineering Service
STANDARD ELECTRIC
TRADE STANDARD MARK
Box 1138 MFG. CO. DALLAS

▸ **Fred Hendrix** of Atlanta, Georgia, has been appointed sales representative for The J. B. Beaird Company,

Fred Hendrix

Shreveport, Louisiana. He will handle sales of Beaird LPG systems, pressure storage, and liquid storage tanks in the Southeastern states. He was previously Southeastern manager of Estate Stove Company, and Southern Gas and Equipment Company of Tulsa, Oklahoma.

▸ **Robert M. Rutledge, Jr.,** was appointed Gulf Coast division sales manager for Lane-Wells, suppliers of technical oil field services. Rutledge succeeds **C. F. Ludwig,** who has been appointed vice-president of Lane-Wells Canadian Company.

Rutledge will be situated at Lane-Wells Gulf Coast division offices in Houston, Texas.

Prior to this appointment, Rutledge had been assistant division sales manager in Lane-Wells Gulf Coast Division.

▸ **T. W. Simmons, Jr.,** the Johnston Pump Company of Los Angeles, California, has been elected vice president and general manager, and **Kenneth G. Lundie** has been appointed general sales manager.

Simmons, until recently, was president of the Johnston Aquamatic Company of York, Pennsylvania. Lundie has been connected with sales in the turbine pump business for over 25 years. He formerly was Western sales manager of the Pomona Pump Company, Pomona, California.

▸ **Charles E. Sharp** has been made Chicago, Illinois, branch industrial manager for Brown Instruments division of Minneapolis-Honeywell Regulator Company, it was announced by W. H. Steinkamp.

Sharp, who has been with the Chicago office for the past five years, succeeds **J. A. Robinson,** who has been made regional industrial sales manager for the Midwest and all western and Pacific Coast areas.

▸ Franklin Supply Company, Chicago, Illinois, has announced the transfer of **Stanley Martin,** vice president, to Mt. Pleasant, Michigan, to handle company operations in Michigan and Ohio. **Kenneth Goodell** has been appointed district manager and transferred to East Chicago, Indiana. **Roy Wood,** vice president, will be in Chicago handling company sales throughout the Chicago area.

▸ **Clark Speirs,** representative, has recently "set up shop" in Fairfield, Illinois. For several years he sold and serviced Globe oil tools in the Bakersfield and Los Angeles, California, area. He maintains a complete stock of Globe junk catchers, all size Globe 2-cutter rock bits for both regular and geophysical drilling, and Globe cross section rock bits.

▸ **John H. Sheusner** was made chief engineer of Enterprise Engine and Foundry Company in San Francisco, California. During his five years with the company as chief design engineer, Sheusner has been in charge of all new design developments incorporated in the complete line of Enterprise diesel engines.

▸ **Emery H. Nielsen,** former service engineer with Dowell Incorporated in Great Bend, Kansas, has been made general sales engineer in Tulsa.

Nielsen replaces **Herb A. Koch,** who was recently transferred to Fort Worth, Texas. He came to Dowell in 1944 after having spent several years in the oil fields. Neilsen formerly was with Boeing Aircraft, Wichita, Kansas.

▸ **John N. Dodds,** service engineer for the Cleveland Trencher Company, Cleveland, Ohio, died in Cleveland

John N. Dodds

July 29 after a long illness. Dodds was 42 years old.

Dodds began his employment with the Cleveland Trencher Company in 1940, and was well known to the pipe line trade from Coast to Coast.

Dr. N. W. Snyder, of the department of Mechanical Engineering, at the University of California, has

N. W. Snyder

joined the staff of Santa Fe Tank and Tower Company, Los Angeles, as chief technical consultant. This announcement came as a prelude to extensive plans for vigorous cooling tower research and development. Dr. Snyder will work in conjunction with L. Obert and A. M. Kuehmsted, veteran members of the Santa Fe engineering staff.

Will L. Corbett has been named to the newly created post of assistant to the district manager of American Steel and Wire Company, Pittsburgh, Pennsylvania.

Corbett, formerly superintendent of industrial relations at the Waukegan, Illinois, plant of the same U. S. Steel subsidiary, will serve on special assignment in his new post. District manager of operations for American Steel and Wire Company in Pittsburgh is **L. F. McGlincy.**

Dean P. Davis has been named manager of Continental Supply Company's Houston store and warehouse.

D. F. Bell, formerly manager of the El Campo store, has been transferred to Corpus Christi as city salesman. He is succeeded by **J. C. Short** in El Campo.

C. A. Robison has been appointed manager of the Casper, Wyoming, store and **B. C. Prowell** fills the same position in the store at Artesia, Colorado.

Blake V. Fisher has joined Rector Well Equipment Company, Inc., as sales representative on the Upper Gulf Coast of Texas. Fisher, who will have headquarters at Rector's Houston Plant, will specialize on the sale of Rectorhead well head equipment and the Rector Fulbore cementing method.

In addition to being a member of the Nomads, he is also a member of the division of production, API.

Specify Thermoid

Photo: courtesy Standard Oil Co. (N. J.)

✓ Check these
"PLUS" Features...
reasons for POWERFLEX leadership!

POWERFLEX Rotary Hose has these *plus* features which mean continuing oil field leadership:

- ✓ Tube—Synthetic rubber, abrasion and oil resistant.
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- ✓ Cover—Special formula resists aging and abrasion.
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- ✓ Pre-testing—Every length is pre-tested to 5,000 psi.

The highest quality materials, modern precision manufacturing equipment and extra care in manufacture are additional *plus* features which guarantee POWERFLEX performance.

POWERFLEX available with male API threads. 2½" (3" thread), 3" and 3½" (4" thread). At your nearest oil field supply store!

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Thermoid Quality Oil Field Products: Oil Country Flat Belting • Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All types of Hose • Molded Specialties • Powerflex Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • Brake Blocks • F.H.P. and Multiple V-Belts.

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Main Offices and Factory • Trenton, N. J., U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products

LAUGH WITH BARNEY

Then there was the one about the girl who wore her dress so low she made the baby cry.

* * *

Waiter: And how did you find your steak, Sir?

Patron: Why, I just moved this little piece of fried potato, and there it was.

* * *

She: You look very downhearted.

He: Yes, my wife has been away six weeks and she's just come back.

She: And does that make you unhappy?

He: Well, I told her I spent all my evenings at home. Today the light bill came in . . . and it's only for 50 cents.

* * *

Rastus: Say, Sambo, what time in yoah life does yo' think yo' wus scared de worstes?

Sambo: Once when ah wuz callin' on a married gal and her husban' came in and caught me. Boy, wuz ah scared!

Rastus: How are you shuah dat wuz de worstes time?

Sambo: Cause her husban' turned to dat wife of his an' says "Mandy, what's dis white man doin' heah?"

* * *

"I married a man in the fire department."

"A volunteer?"

"No, my Pa made him."

A gray-haired chap with a snappy blonde about half his age stopped at a New England hotel. Going up to the registration desk he wrote on the register with a flourish, "Mr. and Mrs. John Smith." The dour old New Englander looked them over with a suspicious eye. "Got any baggage? If ye hain't, ye'll have to pay in advance."

"That's all right," said Mr. Smith; "here's ten dollars and keep the change." That made the proprietor even more suspicious and he said, "I'll have to see your marriage license, Mister."

The chap searched through his clothes but all he could find was a fishing license which he gave to the innkeeper. "Can't read it without my glasses," he was told; "come ahead, I'll take ye to your room."

A few minutes later there was a knock on their door and a voice said, "Say, Mister, if ye ain't done it, don't do it; 'tain't fer it."

* * *

"A good politician must also be an acrobat."

"How do you figure that?"

"Ever try standing on a fence, keeping your finger on the pulse of the nation, pointing with pride and looking to the future while keeping both ears to the ground?"

Two buzzards soared lazily over the desert when a jet propelled plane zipped by them, its exhausts throwing flame and smoke. As it whizzed out of sight, one of the buzzards remarked, "That bird was really in a hurry."

"You'd be in a hurry, too," said his companion, "if your tail was on fire!"

* * *

"Doctor, my son has cholera, and worst of it is, he admits he caught it from kissing the maid."

"Well, well. Young people do thoughtless things, don't they."

"Yeah, but Doctor, I've been kissing the maid myself."

"Too bad."

"And what's more, I've been kissing my wife!"

"What? Oh, my gosh! Now we'll all have it!"

* * *

Cussing, plain and fancy, came from a parked auto. A policeman hurried up and wanted to know what all the fuss was about.

Man: Some so-and-so stole my steering gear.

Cop: Take it easy, just get up here in the front seat where you belong.

* * *

A British delegate to the UN spent some time in New England and was reported to have been shocked by what he called the "open display of sex mindedness in that part of the country." When asked what he meant, he said, "Well, as I drove along your highway, it confronted me again and again. First it was 'Soft Shoulders,' then 'Dangerous Curves,' 'Five Gals for $1,' 'Try Ethyl,' and finally 'Watch Out for Children.'"

* * *

John: Have any of your childhood dreams been realized?

Bill: One of them. When my mother combed my hair, I used to wish I didn't have any.

* * *

Sue: Yes, I wrote a confession story once.

Helen: Did they publish it?

Sue: No, but the editor came all the way from New York to see me.

* * *

The plain, prim little old lady who stood beside a male customer at a department store counter was nervous and embarrassed; finally she said:

"Please Miss, I'd like two packages of bath room stationery."

* * *

A motorist pulled up outside a filling station on which there was a sign: "*Under New Management.*"

"But," said he, "there's the same manager sitting in his office."

"Yes," said the attendant, "but he got married this morning."

PRELIMINARY LIST OF PRODUCING, SHUT-IN, AND ABANDONED OIL AND GAS FIELDS IN WESTERN CANADA

No.	Name of field	Province	Principal Township Location	Discovery date	Producing zone: Local name	Producing zone: System	Type of Production	Number of tests which have been drilled in field: Oil	Gas	Dry holes	Total
1	Armelgra	Alberta	13-13-W4	1943	Ellis	Jurassic	Oil	1	.....	3	4
2	Armena	Alberta	48-21-W4	1948	D1–Devonian	Devonian	Oil	1	.....	1	2
3	Athabasha	Alberta	66-23-W4	1943	Grand Rapids	Lower Cre	Gas	.....	2	3	5
4	Bantry	Alberta	18-13-W4	1947	Bantry	Lower Cre	Oil Gas	2	2	2	4
5	Barnwell (Chin Coulee)	Alberta	9-17-W4	1918	Bow Island	Upper Cre	Gas	.....	2	5	7
6	Barrhead	Alberta	58- 5-W5	1948	Madison	Mississippian	Oil & gas	1	1	.....	1
7	Bassano	Alberta	20-19-W4	1947	Madison	Mississippian	Gas	.....	1	1	2
8	Battleview	Alberta	47- 5-W4	1937	.....	Lower Cre	Gas	.....	1	1	2
9	Baxter Lake	Alberta	46- 5-W4	1946	Wainwright	Lower Cre	Oil	1	.....	.....	1
10	Black Butte-Pinhorn	Alberta	1- 8-W4	1944	Ribbon Sand Basal Sand Madison	Jurassic Jurassic Mississippian	Gas	.....	2	6	8
11	Bon Accord	Alberta	56-23-W4	1949	D2–Devonian	Devonian	Oil	1	.....	.....	1
12	Borradaile (Vermillion)	Alberta	50- 5-W4	1940	Vermillion	Lower Cre	Oil Gas	61	3	13	77
13	Bow Island	Alberta	11-11-W4	1909	Bow Island	Upper Cre	Gas	.....	23	5	23
14	Boyle	Alberta	65-19-W4	1949	.....	Lower Cre	Gas	.....	1	.....	1
15	Brooks	Alberta	18-14-W4	1910	Milk River Sunburst	Upper Cre Lower Cre	Gas	.....	10	3	13
16	Castor	Alberta	38-14-W4	1949	Viking	Upper Cre Lower Cre	Gas	.....	1	.....	1
17	Compeer	Saskatchewan	35-28-W3	1948	Unity	Lower Cre	Oil	2	.....	.....	2
18	Conrad	Alberta	6-15-W4	1944	Ellis	Jurassic	Oil	18	.....	9	27
19	Dead Horse Coulee	Alberta	1-11-W4	1924	..... Ellis	Lower Cre Jurassic	Gas	.....	1	3	4
20	Del Bonita	Alberta	1-21-W4	1936	Madison	Mississippian	Oil	4	.....	3	7
21	Dina	Alberta	44- 1-W4	1925	Meridian	Lower Cre	Oil	7	.....	5	12
22	Dunmore	Alberta	11- 5-W4	1947	Bow Island Ellis	Upper Cre Jurassic	Gas	.....	2	1	3
23	Edgerton	Alberta	45 -4-W4	1947	Colony	Lower Cre	Gas	.....	1	.....	1
24	Elk Point	Alberta	56- 5-W4	1946	Viking	Upper Cre Lower Cre	Gas	.....	3	.....	5[1]
25	Erickson Coulee	Alberta	1-12-W4	1927	.....	Jurassic	Gas	.....	1	2	3
26	Foremost	Alberta	6-11-W4	1923	Bow Island	Upper Cre	Gas	.....	8	5	13
27	Fort McMurray (Abasand)	Alberta	89- 9-W4	1941	McMurray	Lower Cre	Oil	.....	.....	.....	.....
28	Golden Spike	Alberta	51-29-W4	1949	D3–Devonian	Devonian	Oil	1	.....	.....	1
29	Halfway Lake	Alberta	59-23-W4	1948	.....	Lower Cre	Gas	.....	1	.....	1
30	Hanna	Alberta	31-14-W4	1947	Sunburst Sunburst Madison	Lower Cre Lower Cre Mississippian	Oil Distillate Distillate	1	2	2	5
31	Hay Lake	Alberta	1-17-W4	1945	Madison	Mississippian	Oil	1	.....	2	3
32	House River	Alberta	83-16-W4	1917	.....	Lower Cre	Gas	.....	1	.....	1
33	Joseph Lake	Alberta	50-22-W4	1949	Viking	Upper Cre	Oil	1	.....	.....	1
34	Jumpingpound	Alberta	25- 5-W4	1944	Madison	Mississippian	Distillate	.....	3	1	4
35	Kamsack	Saskatchewan	29-32-W3	1937	Boyne	Upper Cre	Gas	.....	57	.....	57
36	Keho	Alberta	11-22-W4	1933	Bow Island	Upper Cre	Oil	1	.....	2	3
37	Keystone	Alberta	27- 6-W5	1947	.....	Cre	Gas	.....	1	.....	1
38	Lac la Biche	Alberta	69-13-W4	1949	Viking	Upper Cre	Gas	.....	2	.....	2
39	Leduc-Woodbend	Alberta	50-26-W4	1947	Viking Central Sand Continental Sd. D2–Devonian D3–Devonian	Upper Cre Lower Cre Lower Cre Devonian Devonian	Gas Oil Oil Oil Oil & gas	212	1	18	231
40	Lloydminster-Lone Rock-Blackfoot	Alberta and Saskatchewan	49-28-W3	1934	Colony Sparky Lloydminster	1 Lower Cre	Oil ..... Gas	321	20	27	368
41	McLaren	Saskatchewan	50-24-W3	1948	Colony	Lower Cre	Oil	2	.....	1	3
42	Manyberries	Alberta	5- 5-W4	1947	Bow Island	Upper Cre	Gas	.....	3	5	8
43	Medicine Hat-Redcliff	Alberta	13- 5-W4	1890	Milk River Medicine Hat	Upper Cre	Gas	.....	80	.....	80
44	Moose Mountain	Alberta	22- 6-W4	1935	Fairholme Ghost River	Devonian	Oil Distillate	1	1	4	6
45	Norman Wells	Dist. of MacKenzie	.....	1920	Fort Creek	Devonian	Oil	60	.....	6	66
46	Peace River	Alberta	84-21-W5	1937	.....	Lower Cre	Gas	.....	5	12	17
47	Pelican Rapids	Alberta	78-17-W4	1912	.....	Lower Cre	Gas	.....	4	1	5
48	Pendant d'Oreille (Pakowki-North Pinhorn)	Alberta	14- 9-W4	1946	Bow Island	Upper Cre	Gas	.....	8	7	15

Prepared by Anthony Folger of DeGolyer and MacNaughton

Full of vigor . . . and rarin' to go! Put *LCP to work and watch ECONOMY IN ACTION! Pumping . . . Pipelining . . . Refining . . . You name it! Regardless of time, place, or specific job . . . you pay for only the power you use. And it's available WHEN AND WHERE YOU NEED IT! COSTS LESS TO INSTALL . . . LESS TO OPERATE. And with *LCP on the job . . . man-power is free for more directly productive duty. Get more facts from the POWER ENGINEER of your Electric Utility Company TODAY!

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PETROLEUM ELECTRIC POWER ASSOCIATION

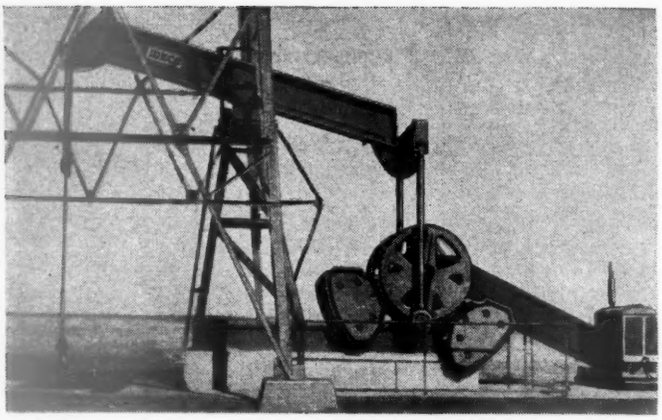
Box 1498, Oklahoma City, Oklahoma

PRELIMINARY LIST OF PRODUCING, SHUT-IN, AND ABANDONED OIL AND GAS FIELDS IN WESTERN CANADA

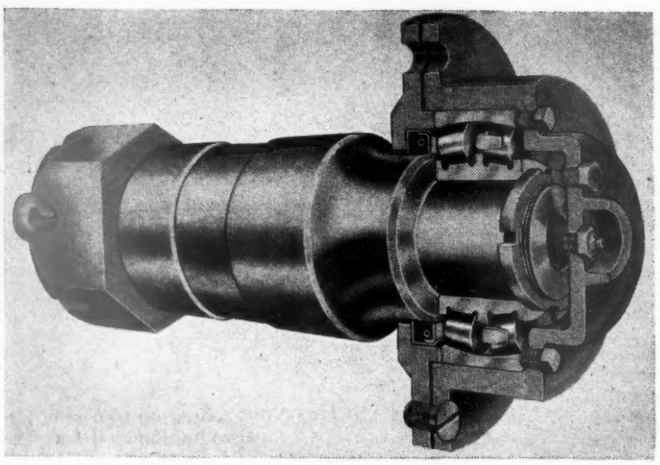
No.	Present status	Gravity	Average depth top of pay zone (Feet)	Average thickness payzone (Feet)	Approximate proven or semi-proven acreage (Acres)	Deepest zone penetrated	Approximate cumulative production as of 12–31–48		Remarks
							Oil (Barrels)	Gas (Cubic feet)	
1	Abandoned	18	3,100	.....	.....	Devonian	462	.....	
2	Producing	39	4,150	7	40	Devonian	1,185	29,934,000	
3	Producing	.....	1,620	20	1,920	Devonian	.....	.....	
4	Producing	25	3,250	10 10	80 640	Devonian	15,700	.....	
5	Producing	.....	2,150	10	1,000	Paleozoic	.....	1,450,000,000[1]	[1]Production to 1-1-48
6	Shut-in	25	4,000	.....	.....	Paleozoic	.....	.....	
7	Shut-in	.....	4,450	.....	.....	Devonian	.....	.....	
8	Shut-in	.....	1,860	20	640	Devonian	.....	.....	
9	Shut-in	17	2,085	.....	.....	.....	2,680	.....	
10	Shut-in	.....	2,970 3,200 3,250	12 6 22	2,170 2,615 740	Devonian	.....	.....	
11	Producing	35	3,585	23	2,000	Devonian	.....	.....	
12	Producing	14	1,800	8 8	1,400 1,280	Devonian	1,090,787	.....	
13	Gas storage	.....	2,065	35	10,000	Devonian	.....	38,000,000,000	
14	Shut-in	.....	1,940	10	640	Devonian	.....	.....	
15	Producing	.....	1,300 3,300	20 10	3,200 1,280	Paleozoic	.....	1,853,202,000[1]	[1]Production to 1-1-48
16	Drilling	.....	3,190 3,500	.....	.....	.....	.....	.....	
17	Producing	12	2,520	5	80	Devonian	886	.....	
18	Producing	25	3,100	5	920	Madison	763,630	.....	
19	Abandoned	.....	2,530 2,665	.....	.....	Madison	.....	1,300,000,000	
20	Producing	38	5,050	12	520	Madison	40,376[1]	.....	[1]Production to 6-1-48
21	Producing	15	1,800	15	160	Paleozoic	47,992	.....	
22	Producing	.....	2,500 3,300	30 17	640 1,280	Palezoic	.....	.....	
23	Shut-in	.....	2,000	25	640	Devonian	.....	.....	
24	Producing	.....	930 1,280	10 12	640 1,280	Silurian	.....	.....	[1]Two Salt wells
25	Abandoned	.....	2,500	.....	.....	Paleozoic	.....	.....	
26	Producing	.....	2,150	10	25,600	Devonian	.....	4,658,000,000[1]	[1]Production to 9-1-48
27	Plant shut down	10	Outcrop	.....	.....	pre-Camb	34,655[1]	.....	[1]Production for 1941-43
28	Producing	.....	5,360	250	2,000	Devonian	.....	.....	
29	Shut-in	.....	2,900	.....	.....	Devonian	.....	.....	
30	Producing	33 66	3,700 3,810 3,680	13 5 10	40 1,920 1,920	Devonian	.....	.....	
31	Abandoned	30	3,080	4	40	Madison	1,140	.....	
32	Producing	.....	600	.....	.....	Lower Cre	.....	.....	
33	Producing	35	3,260	7	40	Devonian	.....	.....	
34	Producing	.....	10,000	147	6,300	Cambrian	9,259[1]	1,120,246,000[2]	[1]Production to 6-1-48 [2]Production to 9-1-47
35	Producing	.....	200	2	3,000	Cretaceous	.....	90,000,000[1]	[1]Production to 1-1-48
36	Abandoned	30	3,680	5	40	Madison	955	.....	
37	Shut-in	.....	.....	.....	.....	Mesozoic	.....	.....	
38	Shut-in	.....	800	.....	.....	Devonian	.....	.....	
39	Producing	27 27 38 39	4,150 4,200 4,900 5,200	10 10 35 35	600 600 23,000 25,000	Silurian	7,332,363[1]	.....	[1]Production to 4-1-49 [2]Reserve for D3 gas
40	Producing	16	1,670 1,850 2,000	..... 10	27,500 19,200	Devonian	2,596,167	1,630,000,000	
41	Producing	16	1,650	7	80	Devonian	2,668	.....	
42	Producing	.....	2,600	10	1,920	Lower Cre	.....	.....	
43	Producing	.....	875 1,075	20	50,000	Jurassic	.....	150,000,000,000	
44	Shut-in	48	1,530 2,650	.....	.....	Cambrian	8,977	.....	
45	Producing	40	1,500	150	4,010[1]	.....	2,743,733	.....	[1]Reserve based on 2,600 acres
46	Shut-in	.....	1,500	.....	.....	Devonian	.....	.....	
47	Shut-in	.....	850	.....	.....	Devonian	.....	.....	
48	Producing	.....	2,100	10	36,000	Lower Cre	.....	.....	

Prepared by Anthony Folger of DeGolyer and MacNaughton

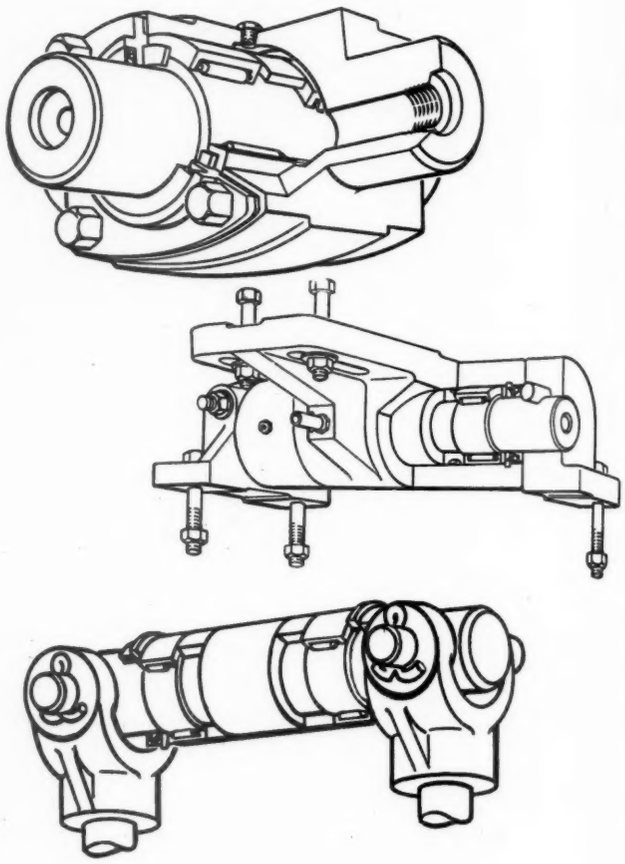
Torrington Bearings give years of trouble-free service in IDECO geared pumpers



Familiar Sight in the oil fields is the steady, reliable "see-saw" of geared pumpers built by International Derrick and Equipment Co. Units built 21 years ago are still on the job. They have been made reliable by such features as Torrington Bearings in many critical applications.



The Wrist Pin Assembly is a typical example. By incorporating a Torrington Spherical Roller Bearing, self-alignment becomes completely automatic. Deflection of the pitman in operation is also accommodated, and bearing cramping is avoided.



These Drawings illustrate the application of Torrington Type NCS Needle Bearings to IDECO equalizer, beam center and rein hanger assemblies. Several features of this bearing have led to its preference. Tremendous radial capacity is provided by its full complement of rollers. It operates directly on a hardened and ground shaft, making an unusually compact and economical assembly. Small diameter rollers assure even distribution of lubricant to all bearing surfaces, despite the difficult conditions of oscillating service.

Torrington Bearings have demonstrated their dependability by providing years of trouble-free service in all types of oil field equipment. Let our engineers help you secure the advantages of efficient operation and low maintenance assured by Torrington Bearings. Write us today. THE TORRINGTON COMPANY, South Bend 21, Ind., or Torrington, Conn. District offices and distributors in principal cities of United States and Canada.

TORRINGTON SPHERICAL ROLLER **BEARINGS**

Spherical Roller · Tapered Roller · Straight Roller · Needle · Ball · Needle Rollers

PRELIMINARY LIST OF PRODUCING, SHUT-IN, AND ABANDONED OIL AND GAS FIELDS IN WESTERN CANADA

No.	Name of field	Province	Principal Township Location	Discovery date	Producing zone: Local name	Producing zone: System	Type of Production	Number of tests which have been drilled in field: Oil	Gas	Dry holes	Total
49	Pincher Creek	Alberta	3-29-W4	1948	Madison	Mississippian	Distillate	1	1	.....	1
50	Princess	Alberta	20-12-W4	1939	Bow Island Basal Alberta Sunburst Detrital Madison Devonian	Upper Cre Upper Cre Lower Cre Lower Cre Mississippian Devonian	Oil & gas Gas Oil & gas Oil & gas Oil & gas Oil & gas	28	25	7	60
51	Pouce Coupe	Alberta	80-12-W6	1941	Peace River	Lower Cre Triassic	Gas Oil	1	2	3	6
52	Provost	Alberta	37 -3-W4	1946	Viking	Upper Cre Lower Cre	Gas Oil & gas	1	5	3	8
53	Rainy Hills	Alberta	19-10-W4	1939	Basal Alberta	Upper Cre	Gas	.....	1	.....	1
54	Ram River-Clearwater	Alberta	37-11-W5	1942	.....	Devonian	Oil	1	.....	5	6
55	Red Coulee (Border Pool in Montana)	Alberta	1-16-W4	1929	Vanalta	Lower Cre	Oil Gas	8	1	7	15
56	Redwater	Alberta	57-21-W4	1948	..... D3–Devonian	Cretaceous Devonian	Gas Oil	37	1	2	40
57	Skiff	Alberta	5-14-W4	1927	Ellis	Jurassic	Oil	6	.....	2	8
58	Smith Coulee	Alberta	3-10-W4	1947	Bow Island	Upper Cre	Gas	.....	1	3	4
59	St Paul	Alberta	58- 9-W4	1947	Viking	Upper Cre	Gas	.....	2	.....	2
60	Stettler	Alberta	38-20-W4	1949	..... D2–Devonian D3–Devonian	Lower Cre Devonian Devonian	Distillate Oil Oil	1	1	1	3
61	Suffield	Alberta	15- 9-W4	1941	Medicine Hat	Upper Cre	Gas	.....	6	.....	6
62	Taber	Alberta	9-16-W4	1937	Taber	Lower Cre	Oil	27	.....	12	39
63	Tilley	Alberta	17-12-W4	1940	Medicine Hat Sunburst	Upper Cre Lower Cre	Gas Oil & gas	1	3	5	8
64	Turner Valley	Alberta	19- 3-W5	1914	Blairmore Madison	Lower Cre Mississippian	Oil Oil & gas	314	311	80	505
65	Twin River	Alberta	2-20-W4	1932	Madison	Mississippian	Oil	4	.....	1	5
66	Unity	Saskatchewan	39-23-W3	1944	Viking Unity Sparky	Upper Cre Lower Cre Lower Cre	..... Gas	.....	8	5	13
67	Vale	Alberta	42- 6-W4	1945	.....	Lower Cre	Gas	.....	1	1	2
68	Vermillion (see Borradaile)	Alberta	49- 6-W4	1939	Vermillion	Lower Cre	Gas	.....	3	2	5
69	Viking-Kinsella-Fabyan	Alberta	48-11-W4	1914	Viking	Upper Cre Lower Cre	Gas	.....	80	22	102
70	Wainwright	Alberta	45- 6-W4	1922	Wainwright	Upper Cre Lower Cre	Oil Gas	8	3	10	21
71	Wetaskiwin	Alberta	46-24-W4	1913	.....	Cretaceous	Gas	.....	3	.....	3
72	Whitemud	Alberta	51-25-W4	1949	.....	Lower Cre	Oil	1	.....	.....	1
								1,139	510	344	1,987

The above tabulation has been assembled from the following sources: [1]—Natural Gas Reserves of the Prairie Provinces by Hume and Ignatieff, 1948; [2]—The weekly issues of Oil in Canada (The Oil bulletin), 1945 to 1949; [3]—Schedule of wells drilled for oil and gas to 1947 in Alberta; [4]—Petroleum Geology of Canada by Hume, Bulletin 98, 1944; [5]—The various June issues of AAPG and other AAPG publications, and [6]— The 1947 Petroleum Review of AIMME. The tabulation is not correct in all details and needs further checking.

The following list of areas has been given by various periodicals as oil or gas fields. These wells have been abandoned, but the results of testing of certain pay zones indicate that further exploration may result in producing fields.

Number	Name	Location	Date	Pay Zone Tested	Type of Production	Depth
1	Brazeau	43-17-W5	1937	Blairmore Paleozoic	Gas Distillate	
2	Craigmyle	32-16-W4	1948	Madison	Oil & gas	4,050
3	Eagle Butte	7- 4-W4	1928	Lower Cretaceous	Gas	3,340
4	Legal-Morinville	56-24-W4	1947	Viking Grand Rapids	Gas	
5	Nose Creek	28 -2-W5	1945	Jurassic	Gas	8,100
6	Onoway	54-27-W4	1949	Devonian	Oil	4,500
7	Oyen	29- 5-W4	1942	Madison	Gas	3,000
8	Pekisko	17- 2-W5	1945	Madison	Gas Oil	1,308 3,145

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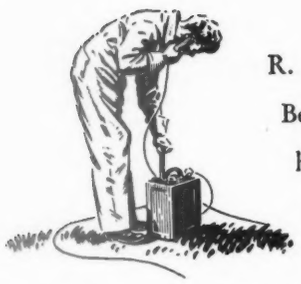
MAGNOLIA

MEN AT WORK . . .

TO HELP TAKE

THE GAMBLE

OUT OF DRILLING



R. E. Horn and John Boddie are out to do a job. Because so many wildcat wells turn out to be dry holes, these men and their co-workers are trying to better the record by "photographing" underground formations . . . to help take the gamble out of drilling for oil. • Their truck is a traveling control center designed and equipped in Magnolia's Geophysical Laboratory in Dallas. It contains a host of sensitive listening devices and delicate electrical instruments. A shallow shot hole is drilled and a charge of dynamite exploded in it to create disturbances that behave like miniature earthquake waves. These reflected waves are picked up with "electric ears" and the resulting impulses are reproduced on a photographic record. Timing must be accurate . . . within 1/10,000th of a second.

• A number of such records or "profiles" tell geophysicists and geologists much about underground structures and the probabilities of finding oil . . . to you it means that some of the gamble is being taken out of finding oil to meet your growing needs for more and better petroleum products.

MAGNOLIA PETROLEUM COMPANY

A SOCONY-VACUUM COMPANY

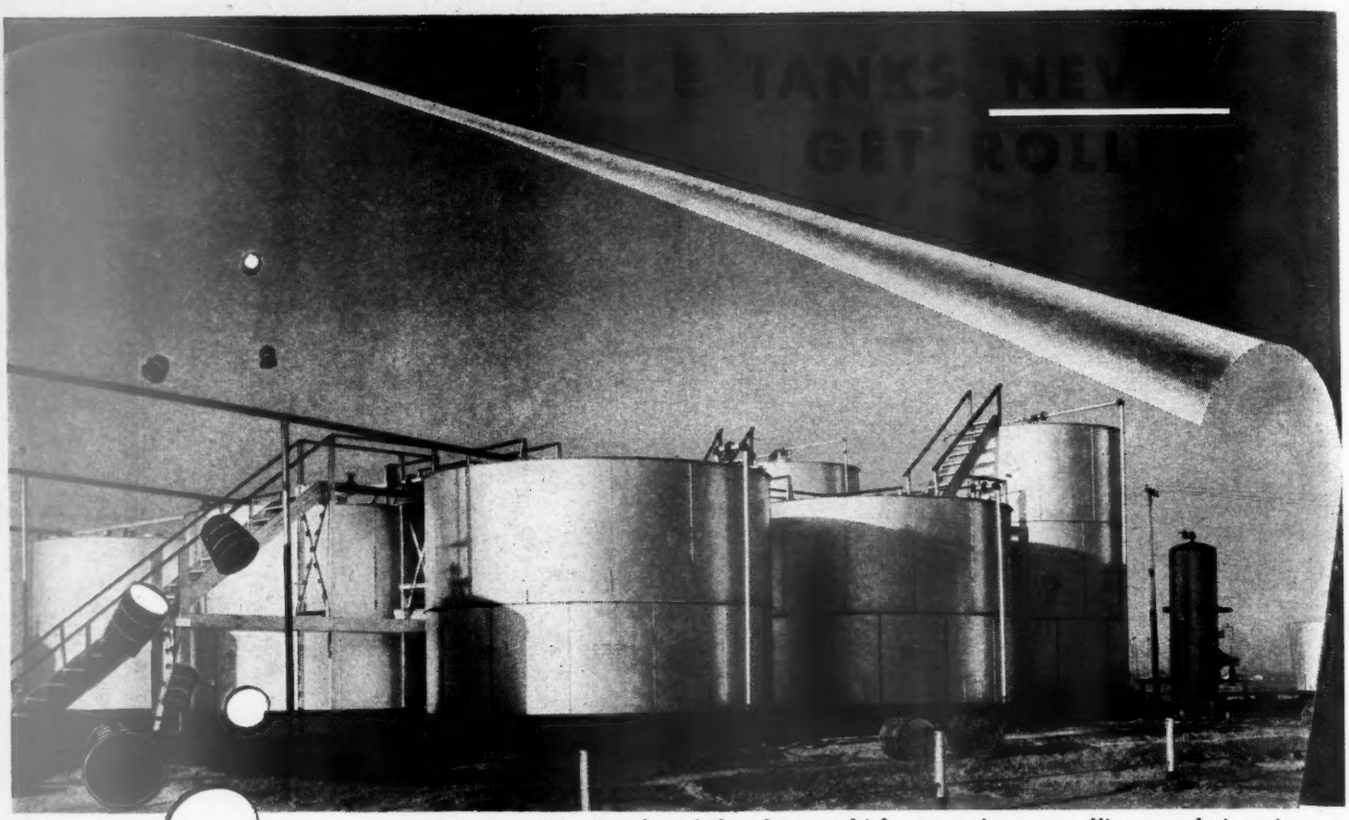
PRELIMINARY LIST OF PRODUCING, SHUT-IN, AND ABANDONED OIL AND GAS FIELDS IN WESTERN CANADA

No.	Present status	Gravity	Average depth top of pay zone (Feet)	Average thickness payzone (Feet)	Approximate proven or semi-proven acreage (Acres)	Deepest zone penetrated	Approximate cumulative production as of 12-31-48		Remarks
							Oil (Barrels)	Gas (Cubic feet)	
49	Shut-in	52	11,700	400	10,000	Madison	.....	.....	
50	Producing	27	2,560 2,500 3,200 3,280 3,300 4,000	10 18 ..... 20 20	700 (oil) 25,180 (gas)	pre-Cam	469,697	1,700,000,000	
51	Shut-in	.....	2,200 4,785	20 20	.....	Devonian	.....	.....	
52	Shut-in Abandoned	 21	2,300 2,525	12 20	5,120	pre-Cam	1,696	4,000,000	
53	Shut-in	.....	2,930	10	.....	Devonian	.....	.....	
54	Abandoned	.....	3,000	8	.....	Cambrian	207	.....	
55	Abandoned Producing	31	2,450 2,375	30	.....	Jurassic	328,711	.....	
56	Producing		2,680 3,200	82	20,590	Devonian	298,689[1]	.....	[1]Production to 3-1-49
57	Abandoned	18	3,075	.....	.....	Madison	8,298	.....	
58	Shut-in	.....	1,830	4	640	Upper Cre	.....	.....	
59	Producing	.....	1,550	10	1,000	Upper Cre	.....	.....	
60	Producing	58 32 28	4,340 5,180 5,300	8 50 50	..... 5,000 5,000	Devonian	.....	.....	
61	Producing	.....	1,100	40	2,000	Upper Cre	.....	62,000,000	
62	Producing	20	3,100	23	1,080	Devonian	1,040,898	.....	
63	Producing Abandoned	 25	1,150 3,170	15 10	640 40	Paleozoic	 14,515	 19,685,000	
64	Producing	43	3,450 9,150	180	160 12,000	.....	91,561,942	1,452,675,000,000	
65	Abandoned	.....	3,900	10	.....	Devonian	7,843	.....	
66	Producing	.....	1,680 2,120 2,000	6 15 15	5,000 3,225 640	Devonian	.....	75,651,000[1]	[1]Production to 1-1-48
67	Shut-in	.....	2,300	10	640	Devonian	.....	.....	
68	Producing	.....	1,600	5	3,700	Cambrian	.....	1,052,438,000[1]	[1]Production to 1-1-48
69	Producing	.....	2,100 2,200	10	300,000	Devonian	.....	101,632,107,000[1]	[1]Production to 1-1-48
70	Producing	20	2,200 2,050	10	200 1,000	Silurian	273,595	.....	
71	Producing	.....	1,300	.....	.....	.....	.....	580,000,000[1]	[1]Production to 1-1-31
72	Producing	.....	.....	.....	.....	.....	.....	.....	
							111,850,863		

The following list of areas has been carried in various periodicals as oil or gas fields. These tests have all been abandoned. Either the potential pay zones were not tested or the testing had no commercial result. Accordingly, they should not be considered as oil or gas fields.

1. Birch Lake
2. Camrose
3. Carbon
4. Claysmore
5. Coalspur
6. Delia
7. Fuego
8. Irma
9. Many Islands
10. Nordegg
11. Ponoka
12. Ribstone
13. Slave Lake
14. Sylvan Glen
15. Tofield
16. Valmer
17. Warner

Prepared by Anthony Folger of DeGolyer and MacNaughton



** When emulsion breakers fail to do a good job, re-treating — or rolling — tanks is a time-consuming, costly job that can be positively eliminated with the proper Visco Treatment.*

Oil on this lease is *Visco* TREATED

Put your lease into the picture above . . . It can be the same story with *your* oil and Visco Emulsion Breakers, aimed at consistently producing dry oil at lowest treatment cost per barrel.

Call Houston, Capitol 7300, collect, for fast action by competent Visco Field Service.

VISCO VS SOLVENT
New, high-flash-point solvent for wax, grease, paint, oil-treating chemicals, and fusible or soft resins. Safe to use on skin, metal or wood. Available now in 5-gallon cans and 55-gallon drums. Write or call for full details and prices.

VISCO PRODUCTS COMPANY
INCORPORATED
City National Bank Building
Houston 2, Texas

***Visco*... CONSISTENTLY EFFICIENT DEHYDRATING AND DESALTING CHEMICALS**

NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating compounds for use in the breaking and resolving of oil emulsions, and to grant licenses for such use, under the following United States patents: 1,886,863; 1,890,863; 1,918,330; 1,927,389; 2,050,039; 2,050,040; 2,208,589; 2,214,788; 2,214,784; 2,235,189; 2,263,414; 2,307,818; 2,318,034; 2,318,035; 2,321,080; 2,386,634. Re. 20,717 and patents pending. Any purchaser of Visco Oil Treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. The royalty for such use is included in the purchase price. Visco Products Company is authorized to and is willing to grant licenses on a royalty basis, to all companies, and to others desiring to practice the patented subject matter, under any and all of the above patents, permitting the user to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents, at a royalty charge of 30 cents per gallon. Application for license should be made to Visco Products Company, Houston, Texas.

new and improved machinery and equipment

A REGULAR FEATURE
appearing in
THE Petroleum Engineer
Irwin-Keasler Building
Dallas 1, Texas

(1) Revolving Casing

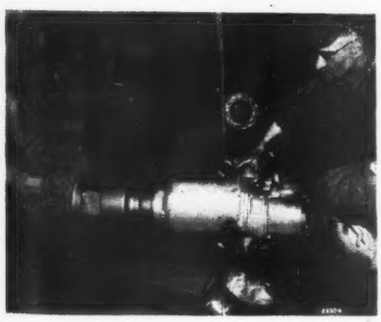
In extending its line of flexible shaft couplings, Diamond Chain Company, Inc., Indianapolis, Indiana, announces also the development of new lightweight revolving casings.

Made of aluminum alloy, they are split axially to permit installation or removal in a space no longer than the coupling itself. These are two types. They are made to engage with the 2-strand Diamond roller chain and are locked in place by the casing.

(2) Impact Tool

A new and larger air impact tool has just been added to the Ingersoll-Rand line for extremely heavy bolting-up jobs, formerly handled, with considerable danger to the man, by sledging or battering box wrenches.

Known as the slugger, the size 588 impact tool is the largest of its type



manufactured and is rated up to 4-in. bolt size.

The impact tool weighs 215 lb and has a free spread of 355 rpm, with 550 impacts per minute. Overall length to shoulder of anvil is 26⅝ in.; side to center distance of the hammer case is 4 in. The new impact tool operates with a 2½-in. square driver.

For further information write to Ingersoll-Rand Company, 11 Broadway, New York.

(3) Tank Truck Pumps

A new power take-off tank truck pump has just been announced by Marlow Pumps, Ridgewood, New Jersey.

The new pump called Type G, is designed especially for petroleum tank truck operations of all kinds where power take-off applications are desired. It is particularly suitable for transports and aviation refuelers. Manufactured in 2 and 3-in. sizes, high and low pressure, with capacities from 20 to 200 gpm, flanged or threaded connections.

The outstanding feature of the pump from the power standpoint is the built-in gear increaser. It is direct coupled to the power take-off.

The gear unit is fitted with a mounting bracket that permits installation in any one of four 90 deg positions. The discharge tee of the pump, similarly positionable, also helps make installation easy.

(4) Pump Construction

Worthington Pump and Machinery Corporation now announces a new inboard bearing construction on its line of GR rotary pumps, which takes the load off the main pump bearings, resulting in longer life and a more rugged pump.

The bearing is an adapter type bearing designed so that the inner race is locked to the drive shaft, close to the load center. This eliminates necessity of the user installing separate outboard pedestal bearings and base.

Get Full Details of October, 1949, Listing—Check and Mail Coupon to

THE PETROLEUM ENGINEER
P. O. Box 1589, Dallas, Texas

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66		

NAME ..... TITLE .....

COMPANY NAME .....

STREET ADDRESS .....

CITY ..... ZONE NO. ..... STATE .....

(5) Vent Valve

The danger of "flash-back fire" in atmospheric storage tanks can be materially lessened by a compact safety device recently put into production by Black, Sivalls and Bryson, Inc., 720 Delaware, Kansas City 6, Missouri. It combines the patented VVH pressure-vacuum vent valve with a flame arrestor bank which acts to prevent propagation of flame into storage tanks containing volatile and costly liquids.

The installation of a flame arrestor as part of the vent valve decreases fire hazards by keeping any outside flame from entering the tank through the vent valve. When a flame arrestor bank is employed with the vent valve, flame resulting from a flash of lightning or from fire near by is prevented from flashing back into the tank.

The flame arrestor bank fits into the throat of the VVH pressure-vacuum vent valve and becomes an integral part of the valve body. Rubber-to-metal sealing makes the valve tight and prevents it from freezing shut.

The combined vent valve and flame arrestor provides fire protection for crude oil, gasoline, and refinery tanks. In chemical plants the unit affords protection to tanks containing volatile materials.

(6) Rustnode

Cathodic Protection Service of Houston, Texas, and Tulsa, Oklahoma, has introduced the rustnode, a new magnesium anode that offers cathodic protection against rust scaling on condenser heads, dividers and tube sheets. The rustnode is designed to supplement water treating for most economical protective results, but in some cases may be used as the only practical means of corrosion prevention in condenser heads. The new anode, which is designed to protect only the walls of the chamber within which it is placed, may be used within both fixed and floating heads.

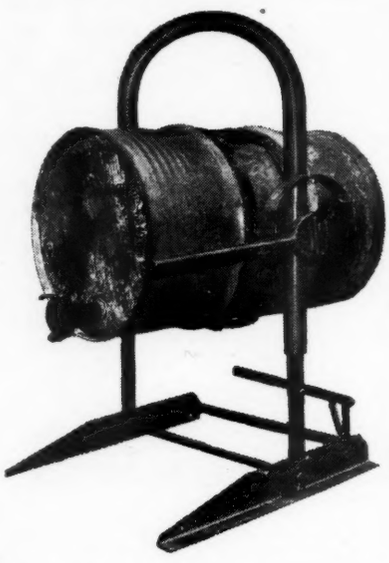
Mounting is determined by distribution need, for the anode should extend into the chamber to a point equidistant between tube sheet and cover plate.

Internal distribution of the new anodes will be dictated by the size of the condenser and the number of its dividers.

(7) Safety Barrel

Henry H. Paris Distributor, Inc., Houston, Texas, has announced the purchase of all patents covering the Western safety barrel stand from Wimbish Sweatt, et al. In addition, the company has purchased the manufacturing facilities of Western Barrel Stand Company, Corpus Christi, Texas, who has been producing the barrel stands for the past few years.

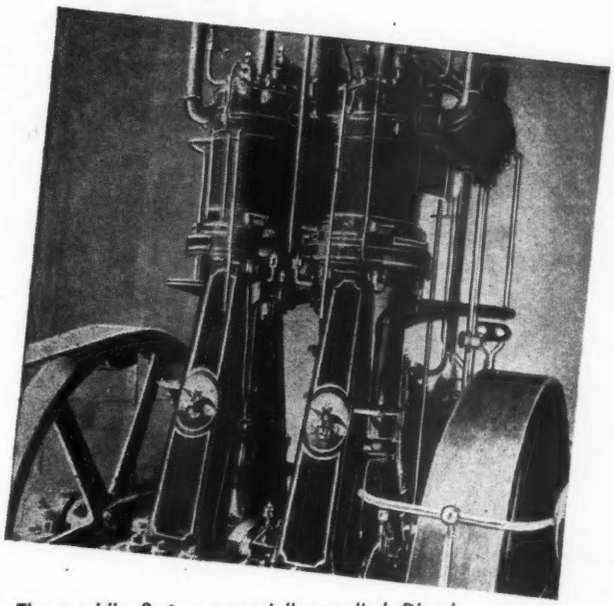
The Western safety barrel stand is



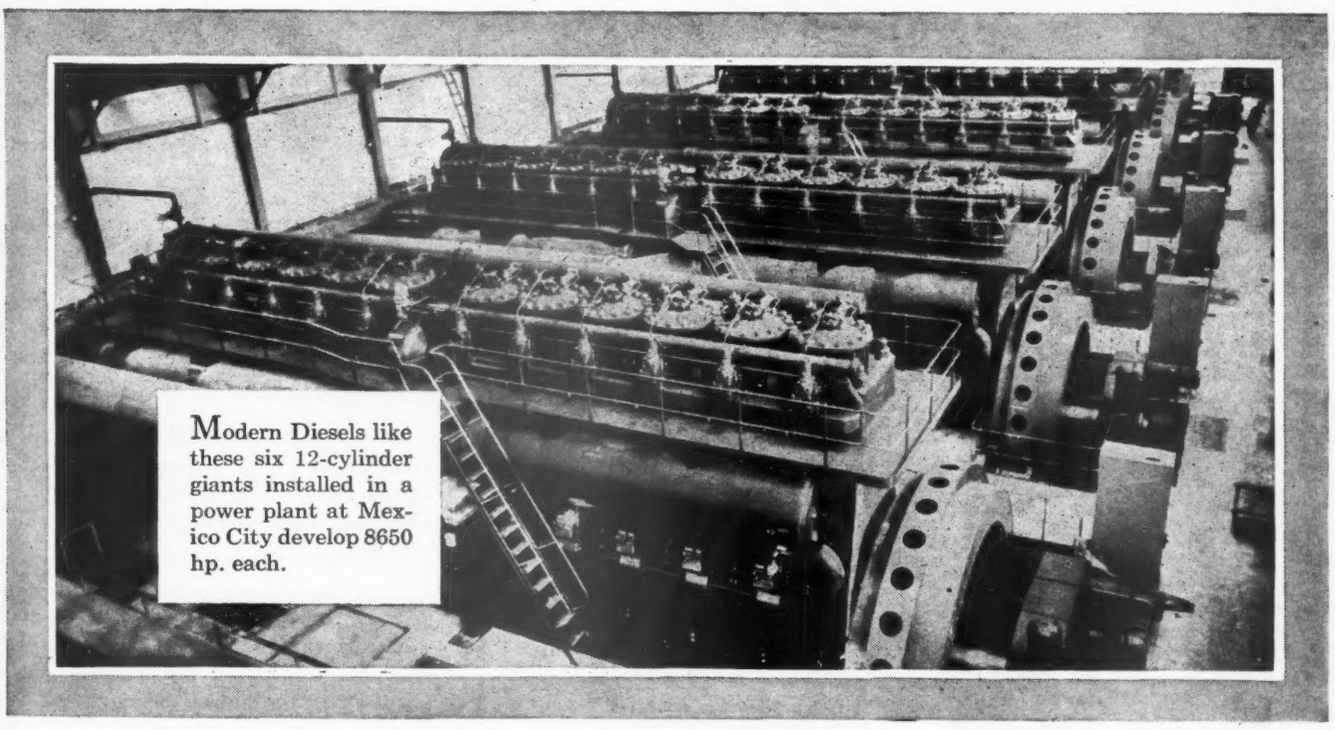
a device for holding 55 gal bbl in such a manner that they can be easily tilted for dispensing the contents. The barrel is suspended by a band around its center in an inverted U frame which is pivoted to the base of the stand. It can be latched in either horizontal, vertical or 45 deg angle positions by means of a tilting lever on one of the U frame legs.

Dr. Diesel's Big Idea

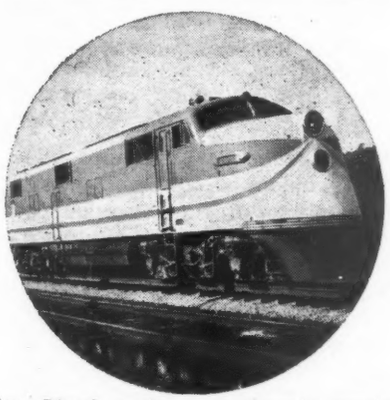
How petroleum progress helped develop a new type of power



The world's first commercially applied Diesel engine, built by Adolphus Busch in St. Louis 51 years ago.



Modern Diesels like these six 12-cylinder giants installed in a power plant at Mexico City develop 8650 hp. each.



Today Diesel engines are largely supplanting steam on the railroads. Giant Diesels develop electricity, power ships. Lightweight Diesels power trucks, buses, contractor's machinery and other units.

Eliminating spark plugs and carburetor, Dr. Diesel in 1892 patented an internal combustion engine designed to run on cheaper, heavy fuels. But years of research were needed to make the idea practical. Engineering research had to find ways to reduce weight and solve the difficult problem of injecting the fuel against high pressure. Petroleum research had to develop lubricants to reduce the fouling of pistons, rings, cylinders and valves under the intense heat and pressure—a field in which Texaco has been pre-eminently successful.

THE TEXAS COMPANY

Petroleum Promotes Progress

TEXACO

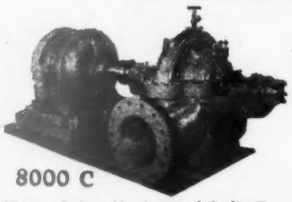
DEAN BROTHERS PUMPS INC.
INDEANAPOLIS, INDEANA.
PUMPING MACHINERY

CENTRIFUGAL PUMPS

RECIPROCATING PUMPS

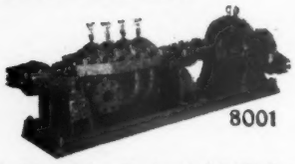
PUMPS

BUILDERS OF OUTSTANDING PUMPS SINCE 1869



8000 C

Motor Drive Horizontal Split Case Double Suction Centrifugal Pump

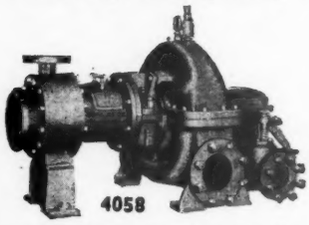


8001

Turbine Drive Horizontal Split Case Multi Stage Centrifugal Pump

4049 A

Two Stage Close Coupled Centrifugal Pump

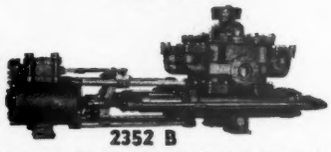


4058

Turbine Drive Close Coupled Centrifugal Pump

942

Single Style, Packed Piston Pattern Steam Pump



2352 B

Durable Duplex, Outside End Packed, Plunger Pattern Steam Pump

3918

Durable Duplex, Packed Piston Pattern Steam Pump

3833

Horizontal Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump

ESTABLISHED 1869

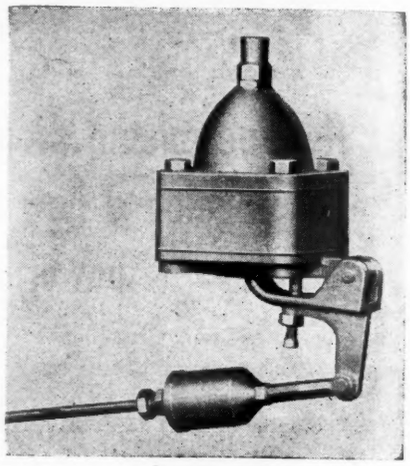
DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W. TENTH ST.

(8) Speed Regulator

An improved regulator for its "Drill-More Capacity Control" of portable compressors is fully described in a new Ingersoll-Rand folder. According to the manufacturer, this new UL-83 floating-speed regulator is much simpler in operation and easier to adjust than the original multi-speed regulator which the Ingersoll-Rand Company, 11



pioneered in 1939. Speed steps and cycling are eliminated.

Whenever less than full capacity of the compressor is used, the new floating-speed regulator slows down the Broadway, New York 4, New York. compressor to the lowest practical working speed that compresses just enough air to hold the pressure. When the air demand changes again, the speed "floats" up or down to the exact speed required. The compressor capacity is varied throughout the entire speed range without speed steps or cycling.

(9) Rotary Hose

Improvements on the life of ordinary rotary hose are now incorporated into the new Goodall flexo long-life rotary hose. In it is provided a corded carcass laid at the same angle as the outside re-enforcing cables. Pressure on this hose, according to the Goodall Rubber Company, Houston, Texas, is like tugging on the famed Japanese handcuffs.

The harder you pulled on those handcuffs the more tenacious the grip. And with the new Goodall hose it is claimed that pressure, even under tortional strain, will only cause the inner fabric to straighten up the more. It will never twist so that the ends of the cords can wear and finally break. All this adds substantially to the life of the hose, providing, according to the Goodall Company, the first real opportunity for the oil industry to actually determine what the life of this type of this hose really should be.

(10) Trailerig

The Cardwell trailerig has proved to be a very popular drilling rig for 5000-ft wells. One of the important features of this highly developed unit is the slightly leaning-type mast which makes possible a completely clear working platform 16 ft sq.

Cardwell has now developed a method of applying this same mast to a trailer on which can be mounted any single engine drawworks. This means that users of appropriate single engine drawworks can now have many of the advantages of the new trailerig and still make use of an existing drawworks.

(11) Helicoid Gage

Helicoid Gage Division, American Chain and Cable Company, Inc., has just added a new 3½-in. dial to its gage line.

This smaller size Helicoid gage is made with a steel Bourdon tube, par-

ticularly adaptable for ammonia ice machines, pumps, compressors, and hydraulic presses up to 10,000 psi.

Besides being available in the new size of 3½ in., the Helicoid gage is also furnished in 4½-in., 6-in. and 8½-in. dial sizes.

(12) Light Weight Tong

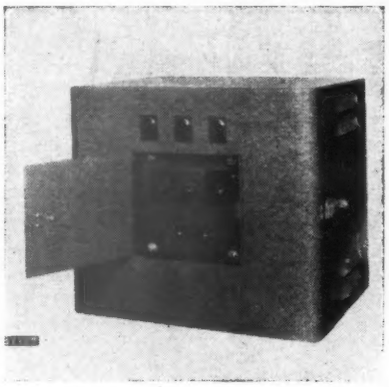
The new Web Wilson Type D tong was designed in cooperation with the engineers of a major manufacturer of portable rigs to fulfill the particular needs of manufacturers and operators of portable mast rigs for shot-hole and geophysical operations. This tong is designed on the same three-jaw principle. It features the spiral hinge pin arrangement and uses very few parts.

The size range of the Tong is changed by merely replacing the lug jaw. Size ranges of the individual lug jaws are as follows: 2⅜-in. to 3⅛-in., 2⅞-in. to 4⅛-in., 4-in. to 5¼-in., and 5¼-in. to 6¼-in.

The distance from the center of the pipe to the end of the lever when the tong is in operating position is 29½-in. It uses standard 4¼-in. long tong dies and a 1-in. diam hinge pin. Weight is approximately 95 lb.

(13) Energy Comparator

Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh, Pennsylvania, announces a new weld energy comparator, which gives a visual or audible, or visual and audible signal. If desired, the unit can be interlocked



for the welding machine to lock out further welding in case the weld energy is not within pre-set limits. This comparator has been designed to check weld energy consistency on applications where high-quality welds are a must.

The weld energy comparator can be used with any Westinghouse single-phase spot welding control. It is provided with a sensitivity adjustment which may be set to any value required for the work, depending on the accuracy of the welding control unit: whether synchronous or non-synchronous. It detects changes in line voltage and changes in duration of welding current.

(14) Radiotelephone Unit

A mobile radiotelephone unit complying fully with the new rules and regulations of the FCC has been developed by Federal Telephone and Radio Corporation, Clifton, New Jersey, manufacturing associate of International Telephone and Telegraph Corporation.

Designated the FT-145-10, the new Federal unit, with a power output of 10 w at any frequency in the 152-162 megacycle band, features modulation limiting and other outstanding design advances.

The modulation limiting circuit in the Federal FT-145-10 is not a compromise or an attachment, but is an integral part of a new, modern design.

Designed to meet RMA test recommendations, the mobile radio draws only 7.3 amp standby and 23.9 amp transmit, thereby allowing in many cases, the use of existing generators and batteries. It has an overall size of $5\frac{5}{16}$-in. high by $12\frac{3}{16}$-in. wide by 14⅛-in. deep and weighs only 27½ lb without cables and control unit.

YOUNG OFFERS THE "HC"

HORIZONTAL CORE

ANOTHER VERSATILE VERTICAL AIR DISCHARGE UNIT FOR . . .

✓ Jacket Water Cooling
✓ Oil Cooling
✓ Gas Cooling, Condensing
✓ Steam Condensing

Basic "HC" Unit may be used in multiples for greater cooling capacity or combination of services.

IMPORTANT FACTS ABOUT THE "HC"

- LOW COST—small initial investment, economical maintenance.
- VERTICAL AIR DISCHARGE—eliminates cross wind effects.
- HIGHLY EFFICIENT—airfoil section fan.
- MULTIPLE INSTALLATIONS — provide greater capacity, combined services.
- NO VIBRATION—adjustable pitch fan mounted separately from unit.
- LARGE CAPACITY—water cooling, from 600,000 Btu/hr up; oil cooling, from 20,000 Btu/hr up.
- LOW HP REQUIREMENT—1 to 10 hp per fan.
- EASY INSTALLATION—simplified piping and frame construction.
- CORE GUARD SCREEN—protects cores from falling objects.

The dual coil "HC" Units, in four sizes, with 2, 4, 6 and 8 coil installations, provide exceptional versatility in heat transfer service. The 4 or 6 blade fan, may be mounted directly on the fan motor shaft, or powered by a v-belt or gear speed reducer drive. Write for full details.

YOUNG (Young Quality)

HEAT TRANSFER PRODUCTS

OIL FIELD, HEAVY INDUSTRIAL, MUNICIPAL & CHEMICAL PROCESS COOLING EQUIPMENT

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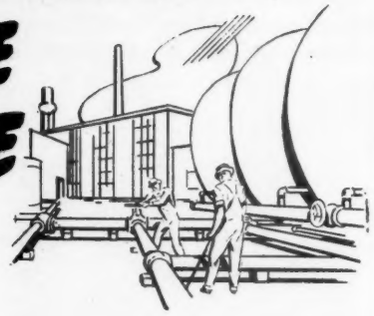
POSTIVE CONTROL with LUNKENHEIMER VALVES

FOR DEPENDABLE LP GAS SERVICE



400 lb., W.O.G. (Water-Oil-Gas)
Fig. 400, GLOBE
Fig. 401; ANGLE

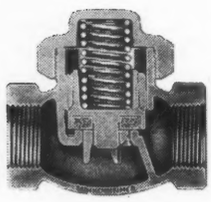


Fig. 403
LIFT CHECK WITH SPRING

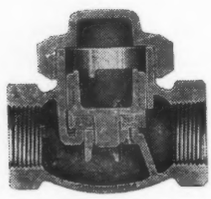


Fig. 402
LIFT CHECK

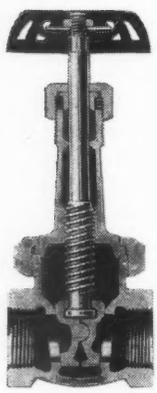


Fig. 404
Bronze Union Bonnet Gate Valve
Bronze Union Bonnet Gate Valve
400 lb. W.O.G.
¼ in. to 3 in.

For Liquefied Petroleum Gases . . . in LP-Gas systems, bulk transfer and storage tanks, domestic cylinder charging manifolds, vapor differential compressors and the many industrial uses . . . Lunkenheimer 400 lb. LPG Valves meet every need. Designed for this service and reflecting Lunkenheimer Quality throughout, these rugged valves have special packing, and in globe, angle and check valves, a special, easily renewable non-metallic disc. These valves are approved by Underwriters' Laboratories, Inc., for LP-Gas.

LUNKENHEIMER DISTRIBUTORS are located in all oil producing and refining centers. Write for Bulletin 576, or ask your distributor for a demonstration of Fig. 400 "N-M-D" Valves for Liquefied Petroleum Gases.

ESTABLISHED 1862
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"QUALITY"
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NEW YORK 13 CHICAGO 6
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EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

(15) Filter Press

A new simplified, dead weight hydraulic pressure unit for use in determining the filtration characteristics of drilling mud has been developed by

Baroid Sales Division, 830 Ducommun Street, Los Angeles 2, California. The unit attaches easily to the standard Baroid No. 300 filter press and eliminates the need for outside pressure sources. The only requirement being a pint of fresh water.

The Baroid dead weight hydraulic filter press provides the operator with a source of constant hydraulic pressure. It is especially recommended for drilling operations in remote or overseas areas where compressed nitrogen is difficult or impossible to obtain.

The dead weight assembly delivers 100 lb per sq in. pressure (+5 psi) to the filter cell as prescribed in API Code No. 29. The assembly is composed of a water reservoir, piston and cylinder, dead weight, delivery pressure gauge, two check valves, and a bleed-off valve.

(16) Roadair Rig

A compact rig measuring 12 ft wide and capable of being moved in a single load has been designed and placed in production by Wilson Manufacturing Co., Inc., Wichita Falls, Texas.

Known as the Wilson roadair giant, the rotary rig is powered by two engines with a total input of 500 hp and is rated to 7500 ft with 4½-in. drill pipe or 9000 if 3½-in. pipe is used.

The cathead shaft is so arranged that either plain or spinning line catheads can be furnished on the driller's side and either automatic or breakout catheads can be used on the opposite position.

Brakes used are a new type with long equalizer and a single nut adjustment.

The drum is a full 42-in. width.

(17) Skidless

A new protective coating material for skid proofing surfaces made dangerous because of their slickness, such as around machinery or equipment in industrial plants, has been placed on

the market by Plastic Coating Corporation, Houston, Texas.

Skidless is impervious to practically all petroleum products and can be applied to metal, wood, or cement or canvas. This coating is manufactured under the name, Skidless. It may be readily applied by brush using usual technique. This coating will be available in both quarts and gallons and in abrasives of either fine or coarse type.

(18) Dry Lubricant

A new grade of Molykote lubricant, known as Type Z, has been made available by the Alpha Corporation, Greenwich, Connecticut. This new lubricant is a specially prepared, smooth-textured molybdenum compound powder whose treatment and composition renders it peculiarly adapted for extreme bearing pressure applications.

Molykote resists the attack of all but a few acids, and its lubricating characteristics are not affected by temperature from the sub-zero range up to 750 deg. Another feature is that it has an affinity for tenacious adherence to metal surfaces, a quality which combined with film strength prevents galling and seizing at bearing pressures in excess of the yield strength of most metals.

Molykote, Type Z, may be applied dry in the powder form or it may be mixed with solvents, oils or greases. It is finding increasing use as a wear-in lubricant for dies, gears, and machinery. It excels as a thread lubricant, especially on threaded connections subjected to high temperatures for sustained periods. It effectively prevents freezing of threaded connections. Applications of Molykote have made it easy to do some really tough jobs of drawing and cold forming stainless steel and other materials.

(19) Panel Instruments

A complete new line of 3½-in., long-scale panel instruments of internal-pivot-type construction has been announced by General Electric's Meter and Instrument Divisions, Schenectady 5, New York.

Designated as Types DO-81, direct current, DO-82, thermo-couple, and DO-83, rectifier, the new instruments employ standing 3½-in. round and square cases with 250 deg scales 4.92 in. long for good readability.

Designed for general industrial applications, the instruments have permanent-magnet, moving-coil mechanisms. With the exception of high-sensitivity microammeters, they are available in all ratings now listed for conventional 3½-in. instruments with 90 deg scales.

(20) Plug Valve

Fluid passage through high pressure lines may be controlled quickly and with a minimum of effort by means of the new LJS plug valve, states the manufacturer. This valve, a product of the Johnson Foundry and Machine Company, Los Angeles, California, utilizes a cylindrical plug which rides top and bottom on sealed ball bearings. This construction completely eliminates the need for lubrication and permits quick and easy rotation of the plug without the danger of sticking, according to the makers. Only one-quarter turn of the control wrench is necessary to rotate the plug through its full operating range.

(21) Junk Snatcher

The multi-surge junk snatcher, manufactured by The Cavins Company, 2853 Cherry Avenue, Long Beach 6, California, is a hydrostatic multiple-action tool that is run with drill pipe or tubing to clean out holes of removable junk, rock bit cutters, blades, millings, scale, broken slips, dies, broken cement retainers, etc.

The tool is run in the hole assembled in a string of drill pipe or tubing and by simple top-hole manipulation utilizes controlled and limited surges of the hydrostatic head in the well to pick up and retain bottom hole junk or fish.

Each complete surging cycle of the Cavins multi-surge junk snatcher is instantaneous, and the operator need only pick up the fishing string to ready the tool for repeated surges.

In addition to the hydrostatic surge action employed to "wash" junk into the tool, the Cavins multi-surge junk snatcher can be rotated and used with milling shoes and other attachments to remove bridges or break, shape, or center junk prior to each surge.

(22) Life-Line Motors

New type CSP Life-Line motors, especially designed for deep well turbine pumps, are announced by Westinghouse Electric Corporation, Pittsburgh, Pennsylvania. These weather

proof, vertical hollow-shaft motors can be furnished as a complete motor, a motor without base, or as a stator and rotor only.

Typical uses of these motors include paper mills, irrigation work, construction projects, municipal pumping stations and similar applications where an efficient constant speed motor is required.

The horsepower is 1 to 20; cycles, 60, 50, 25, and volts, 208, 220, 440, 550. NEMA standard dimensions—frames 225 to 326.

(23) Lined Pipe

The Michigan Pipe Company, Bay City, Michigan, announces the production of large sized steel pipe and fittings lined with saran rubber 187. The development complements the line of saran lined pipe in smaller size ranges which for some months has been manufactured by The Dow Chemical Company and distributed through the Saran Lined Pipe Company, Detroit, Michigan.

Saran rubber 187, a Dow product, is especially resistant to abrasion and excells as an inert lining material when in contact with petroleum products, chlorinated hydrocarbons, bleaching agents, general acids, and most chemical mixtures. The standard saran rubber lining is ⅛ in. thick and, in general, its operating temperatures range from —5 F to 167 F dependent somewhat on service conditions.

The Michigan Pipe Company produces the steel pipe lined with saran rubber 187 in all standard sizes from 8-in. to 36-in. inclusive. Standard fittings lined with saran 187 are also produced in the same size range.

trade literature

PUBLICATIONS LISTED ARE SENT FREE UPON REQUEST

(24 Cork-Rubber Mounting

For the majority of applications, Elasto-Rib, a low cost cork and rubber mounting requires no bolting or cementing. This material for controlling transmission of vibration and noise is described in a new bulletin just released by the Korfund Company, Inc., 48-43-D, Thirty-Second Place, Long Island City 1, New York.

Greatest efficiency is obtained in the recommended loading range of 750 to 5000 lb per sq ft. Methods of installation are described and illustrated. The material is available in sheets 24 in. by 36 in. either from mill supply houses or direct, or can be had cut to size and shape as required.

Three types of damper are also described, all of which make use of Elasto-Rib's advantages. Their loading range runs from less than 40 lb per unit to more than 1250 lb. Ask for Bulletin ER-701.

(25) General Catalog

The Larkin Packer Company, Inc., is now distributing its 1949-1950 general catalog. This catalog contains illustrations and descriptions of the entire line of Larkin cementing and production equipment.

Requests should be addressed to Larkin Packer Company, Inc., St. Louis, Missouri.

(26) Valve Controller

Fisher Governor Company, Marshalltown, Iowa, is now in production on its new Series 3500 valve controller, the Positrol.

The Fisher Positrol is very simple in design, consisting of a few levers, a bellows unit and a spring. Valve travel is easily adjustable between ¼ in. and 3 in.

The Positrol is a force balance type valve controller, is available with or without by-pass, and may be used as a remote position indicator.

The Positrol is completely described in Fisher Bulletin 3500. Copies may be secured from Fisher Governor Company, Marshalltown, Iowa.

(27) Standard Steel Lists

Standard steel lists combined in one data folder are offered by The Babcock & Wilcox Tube Company. Chemical compositions are given for basic open-hearth and acid-bessemer carbon steels and resulphurized steels, for open-hearth and electric-furnace alloy steels and for stainless and heat-resisting steels, all subject to standard variations for check analysis. Giving the AISI number with the SAE number, these are convenient lists for cross reference.

The Babcock & Wilcox Tube Company, 85 Liberty Street, New York 6, will send these lists to you.

(28) Magnesium Anodes

Magnesium anodes for cathodically protecting pipe lines and other metal structures, marketed by Dowell Incorporated, a wholly-owned subsidiary of The Dow Chemical Company, are described in some information sheets released by the company. The electrical ratings, weights, sizes, and forms of the various anodes are included.

Dowell Incorporated's address is Kennedy Building, Tulsa 3, Oklahoma.

(29) Safety Switches

A new four-page bulletin giving factual information about Type "A"—Style "A" heavy-duty industrial safety switches has now been made available by The Trumbull Electric Manufacturing Company, Plainville, Connecticut.

Describing these switches as able to withstand years of rough usage, the bulletin states that they have been given careful and rigid inspection by Trumbull.

The bulletin contains information about the types of applications these switches have been designed for, extent of the line, horsepower ratings, and give specific information on how to order and how to specify.

(30) Hardfacing

The availability of a helpful, new reprint "The Economies of Hardfacing" has been announced by Air Reduction Sales Company. Written by J. J. Barry and Albert Muller, this reprint originally appeared in article form in "The Welding Journal." The 8-page reprint, profusely illustrated with 14 photographs, reviews the advantages of hardfacing and offers an analysis of the problems leading to the correct selection of the proper hardfacing rods. Design and cost figures are offered, plus a selected bibliography.

Write to Air Reduction Sales Company, 60 East 42nd Street, New York 17, for this reprint.

(31) Single Phase Motors

The Louis Allis Company, Milwaukee, Wisconsin, has recently announced that they are in production on a new line of integral horsepower, single phase motors. The new line is available in open drip proof; splash proof; totally enclosed; fan cooled; and explosion proof construction. It is identical in appearance to the polyphase motor of the same enclosure and is built in the same rugged construction. Bulletin No. 722 describes the line.

(32) Alloy Steels

A new bulletin, "Alloy Steels for Ball Mill Liners and Grates," has been released by the American Manganese Steel Division of American Brake Shoe Company. Copies are now available and will be mailed upon request. Ask for Bulletin 449-ML.

This twelve-page booklet recommends the alloy steel or iron best suited to meet different impact and abrasion combinations which exist in grinding mill installations in basic industries such as metal mining, non-metallic minerals, and portland cement production.

(33) Chains-Sprockets

Diamond conveyor chains and sprockets are fully illustrated and described in a new 28-page Bulletin No. 29 just released for distribution by the maker, Diamond Chain Company, Inc., Indianapolis 7, Indiana.

The Chains are made in pitches ranging from 1 in. to 4 in. with standard and large rollers. Standard attachment links, extended pins, stainless steel, bronze and top plate chains along with appropriate sprockets are also described.

(34) Construction Report

A new 28-page, fully-illustrated report is offered by the Portable Bridge and Equipment Company, Gulf Building Addition, Houston, Texas, as free introductory information prepared to acquaint the oil, gas pipeline and construction industries with the variety of possible uses of several basic materials and methods now available on a rental basis for constructing temporary bridges, barges, and roadways.

Among the materials discussed in the report are steel treadways, trestle columns, pneumatic floats, Bailey bridges, steel pontoons, portable steel cubes, access ramps, roadway materials, plus applications and capacities of each.

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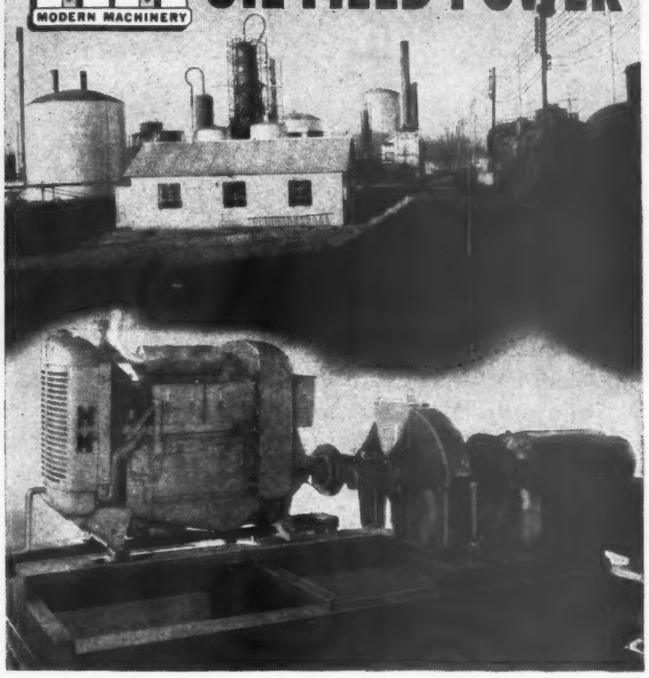


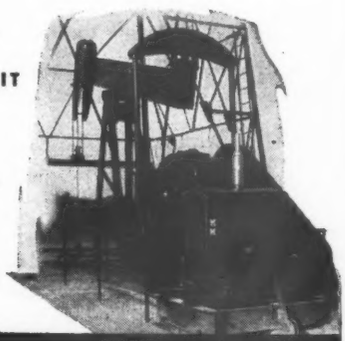
MM Model 206A-4A Power Unit Operating Transfer Pump At Refinery.

Heavy-duty MM power units are built with quality controlled parts that are of heavier design and extra strength for greatest stamina on continuous duty applications on oil well, pipeline and refinery jobs.

One of the great *MM Special Features* is the *MM Exchanger Base Pan* teamed with *Regulated Cooling.* This feature maintains uniform operating temperatures throughout the engine and greatly prolongs engine life and periods between oil changes. Naturally, this also means that maintenance is cut to a minimum.

Additional service and maintenance economy features include: *Moly-die-block steel valve inserts* for greater resistance to heat and corrosion. *Highly standardized design* of models. *Easy accessibility to all operating units,* such as water pumps, oil pump, governor, oil filter, valve adjustment and magneto.

MM MODEL 283-4A OIL FIELD UNIT



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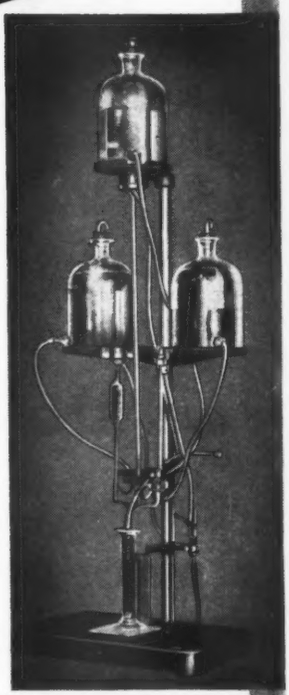
SULFUR and CARBON *Analyses* in PETROLEUM PRODUCTS

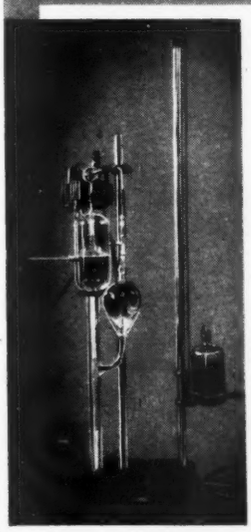


The sulfur content of oils, waxes and greases is often an important measure of the value and quality of the product.

Whether the desired sulfur content be high, low or medium, it is necessary to know exactly what amount is present.

The combustion method offers a rapid and sure means of determining sulfur in the wide range of percentages and materials encountered in the oil and grease field.

The Dietert-Detroit Sulfur Determinator embodies the correct principles of the combustion method in a simple, rugged and convenient form. It is supplied complete to operate as a self-contained unit, independent of other analytical equipment. Complete analysis can be made in less than five minutes.



Carbon determinations on organic compounds are being made in as little as two minutes with the Dietert-Detroit No. 3003 Carbon Determinator.

This method can be applied to any petroleum product that can be weighed into an open combustion boat. One example of the usefulness of this method is the analysis of cracking catalyst for carbon content.

Leading oil companies* are taking advantage of these versatile, time-saving determinators. Write for detailed information on how you can apply rapid carbon and sulfur analysis to your problems.

*Two typical users— THE SHELL OIL COMPANY, THE PURE OIL COMPANY

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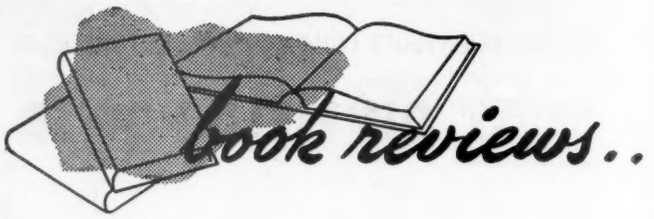

▸ **Trade-Marks,** *by H. Bennett. Chemical Publishing Company, Inc., 26 Court Street, Brooklyn 2, New York. Pages, 479. Price, $10.*

The principles of coining trade-marks, pertinent legal aspects, and a trade-mark dictionary comprise this book. Included in the latter section are lists of trade-marks pertaining to chemicals and allied products, their owners, and the composition of the products. In the pocket on the back cover is a set of concentric wheel "name-finders" that facilitate coining trade-names.

▸ **Aluminum Alloy Castings,** *by Floyd A. Lewis. The Aluminum Association, 420 Lexington Avenue, New York 17. Pages, 64. Price, $0.50.*

Material for the 14 articles appearing in this composite reprint was obtained in a postwar survey and hence reflects many wartime advances in the aluminum casting art. The booklet covers the production and application of aluminum alloy sand and permanent-mold castings.

▸ **Exploration for Oil and Gas in Florida,** *Information Circular No. 1 (Revised), by Herman Gunter, director, Florida Geological Survey, Tallahassee, Florida. Pages, 106. Price, $1.*

This circular is largely a reprint of Circular No. 1 with the incorporation of exploration activities for 1948. It contains appropriate changes and additions in the text to bring all available information on the subject up to date as of January 1, 1949.

▸ **The American Oil Boom—Second Stage,** *by Charles S. Roberts, 17 East 42nd Street, New York 17. Pages, 8. Price, $1.*

This special bulletin on the outlook for the oil industry contains a forecast on the price of crude oil, and estimates on consumption, imports, and earnings. If reflects a more favorable position for the industry than that predicted by some other investment agencies.

▸ **How to Keep Invention Records,** by Harry Aubrey *Toulmin, Jr., Research Press, Inc., Dayton, Ohio, Pages, 78. Price, $2.50.*

Clearly stated in this book is the nature of industrial property, and a system is formulated, founded on the statutes as interpreted in numerous court decisions, to determine the first user or inventor. Some 50 pages of the book are devoted to record forms and their explanation.

▸ **Coding of Thermocouple Wire and Extension Wire,** and **Manometer Tables.** *Pages, 4 and 32, respectively.*

The Instrument Society of America, 1117 Wolfendale Street, Pittsburgh 12, Pennsylvania, has published the two foregoing tentative recommended practices, which are available free to members and for $1 and $2, respectively, to nonmembers.

▸ **Design for Welding,** *edited by Robert S. Green. The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. Pages, 1024. Price, $2 in USA, $2.50 elsewhere.*

The 82 papers comprising this volume were selected from more than 1100 entries in the Award Program conducted by the Foundation. Their publication affords a record of representative welded designs. Emphasis has been placed upon projects that have been produced and are in operation.